The Chemical Age

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Notes and Comments

Chemical Works Maintenance

IT is instructive to visualise the differences which exist between industrial practice to-day and that of the past generation. There is to-day a greater range of products and for that reason an increased number of processes. The number of processes in use for the production of any given product has not increased in general, for the newer processes have displaced the older when they have proved more efficient in respect to costs, to purity of product, or ease of continuity of operation. In the last few words we have the epitome of the changes brought by the passing years—costs, purity, continuity. The trend of chemical industry is in the direction of lower costs and cheaper selling prices, of a better and purer product, and of delivery to a time schedule. Whether we like it or not, gone are the days when letters were written by hand.

Let any business executive or chemical engineer contrast these times with the present practice, and then let him ask himself what are the principal factors which enable the new conditions to be rigidly met. There are a number of them, of course, organisation of production, organisation of staff and workmen, chemical control of processes, the installation of new processes and plant whenever this proves advantageous; but transcending all in everyday importance is that of maintenance. It is the recognition of this fact which has been the key-note to the production of the present issue of THE CHEMICAL AGE, devoted to the problems of maintenance at chemical works.

Maintenance has Many Aspects

THE maintenance staff of any works must be continually on the alert to lengthen the life of the plant as much as possible. The breakdown, when it occurs, may be chemical or mechanical; it may be due to the action of the chemical materials being treated upon the metals of which the containing vessels are made, or it may be a purely mechanical breakdown of machinery, such as might affect any plant. Often it is a combination of the two, and the cause is not easy to discover. What chemical engineer has not been perplexed by repeated failure of an essential link in a process under his control? The break-down, moreover, may not be inherent in the process.

We have known a process working perfectly in one works, which yet involved heavy maintenance costs in another works, although no obvious differences could be detected in the two instances. Materials, practice, products were all the same. Maintenance may be puzzling at times and may present problems peculiar to itself. Many of the breakdowns, of course, are of the simple mechanical type which can readily be foreseen. In this case the obvious remedy, and one which all efficient works engineers apply, is the provision of adequate stand-by plant, or spare parts. That is an insurance against lengthy stoppages which every works must adopt, and is a common-place of the organisation of all efficient works.

Investigating Breakdowns

EVERY works but the very smallest should have a maintenance department, consisting not only of the usual few fitters and bricklayers, but including an engineer and a chemist whose sole duty it should be to consider maintenance in all its varied aspects, to select new plant with particular reference to the materials to be handled and the duties it will be asked to perform, to investigate closely every breakdown with a view to its avoidance, and to examine critically every operation throughout the works in order to reduce the maintenance costs. It may be objected that this is done already in a general way by the chemists and engineers in charge of each process, but although they will give attention to the more obvious causes of failure, their duty is primarily production, and once the plant is again functioning the cause of the breakdown and its avoidance tend to be dismissed from the mind until circumstances again force it into the forefront.

Let any works manager calculate the annual cost of his replacements over a period of years; let him add to that the cost of the total stoppages of plant which inevitably occur from time to time; let him calculate the loss in good-will of the customer when "circumstances" prevent the delivery of the goods at the promised dates; if he will then put against these items the cost of giving skilled assistance to the maintenance staff on the lines here suggested, we feel sure that in very many instances, the value of our suggestion will be apparent.

Reduction of Maintenance Costs

EXCESSIVE maintenace costs may, amongst other potent factors, be caused by corrosion—perhaps the most potent cause, by vibration, by faulty arrangement of plant, by placing certain portions of the plant where they cannot be attended to without some discomfort and so forth. We recollect, for example, a pump placed under a tar tank from which tar would periodically overflow whenever a blockage occurred in certain mains so that the operator had to walk through tar to attend to it; we recollect another placed so that the attendant was lucky if he escaped a light sprinkling of sulphuric acid. The lay-out was

designed by draughtsmen with no practical knowledge of the working of a plant, and who did not foresee these difficulties. The subject of the reduction of maintenance costs by the careful lay-out of the plant is one that has received insufficient attention. Greater care should be taken of this aspect of the subject when designing a new plant.

Every successful chemical works grows with the passing years. New processes, the extension of old processes, stand-by plant, all add their quota. It may be that the site is insufficient, it may be that the immediate cost is the only thing considered; the saving of a few yards of steam piping may decide where a new pump or even a new plant is to be situated. The ultimate result may be the expenditure of far more in maintenance than the original plant cost, but because this expenditure is extended over a period of years, it is less obvious and does not attract attention. The provision of a scientific maintenance staff would go far to prevent all these concealed sources of loss.

Larger Production Units

THE greatest single cost in starting many manufacturing processes is the initial cost of plant. The tendency to-day in most branches of industry, in which the chemical industry is no exception, is in the direction of larger units of production in order to reduce the working and labour costs. The mechanical side of the subject is increased in importance. These huge units are more and more costly. Failure of plant is ever more expensive, stoppage of plant is becoming ever more serious, the work of the maintenance engineer is becoming increasingly urgent. The high amortization cost of many processes operates against their financial success and in the struggle for lower production costs the value of the services of a really efficient maintenance staff cannot be over-rated. The value of this staff may be apparent to the larger concerns, but it must clearly affect the smaller ones just as much. The fewer units at the smaller works makes the efficiency of each indvidual piece of plant of still greater moment.

Into the question of the maintenance of human material we need not enter here, beyond stating that the maintenance staff should be held immediately responsible, in collaboration with the works manager, for the protection of the workers from accidents—not the maintenance staff as now usually constituted, but the scientific maintenance staff of the future. The lay-out of the plant to avoid excessive wear-and-tear of materials will also avoid deterioration of the human factor. Noise, vibration, fumes and so forth may prove as destructive to the one as to the other. In the course of years staffs change for a variety of reasons. The wise manufacturer has replacements on hand; young men are being trained to take the place of those who go; he has his eye on others of more mature experience who can be brought in as soon as room is available in order to strengthen his organisation with men of other experience; there is a wise provision for the future in regard to both of these. As much attention must be paid to the maintenance of the animate as of the inanimate. In this way the works may attain that continuity of policy coupled with a knowledge of developments and practice elsewhere.

The Report of the D.S.I.R.

THE inception of the Department of Scientific and Industrial Research may well prove to have been one of the master-strokes of our generation. A perusal of the 193 pages which comprise this year's annual report reveals so diverse and vast a volume of important investigations as to stagger the imagination. It is unthinkable that much of this work would or could have been undertaken without the guidance and help of the Department. The work in hand and the past achievements of the Department are in the wildest sense the concentration of scientific research in the service of the industry. There have always been those to whom research is the dominating passion, but if we contrast the research conducted before the Department was formed with that recorded in the annual reports the evidence of the progress made becomes striking.

The difference lies partly in the magnitude of the operations, partly in the amount of money expended, and partly in the substitution of definite schemes of research conducted by whole time workers operating in teams, for the individual efforts of those who were primarily teachers of science in our universities. The work done by the individual was striking, and individual work is still necessary, but there is a definite place for team work. In view of the value of the Department an expenditure of half a million pounds, one-sixteen-hundredth of the annual national expenditure, must be deemed cheap.

A Useful Extension

WE have recently been told that some research organisations have failed because "they were entrusted to workers who by temperament or training were not suitable for the work." A correspondent in our columns asked in vain for some enlightenment as to the procedure by which directors of research were chosen. Could not the Department of Scientific and Industrial Research form a register of those, and there must be many, able and willing to engage in scientific research? We can imagine the list being graded by the achievements of the individual and the confidential reports of those really in a position to assess his work. It is not intended that the Department would assume the functions of an employment agency, but if the qualifications required for recommendation by the Department were placed very high many unsuitable appointments would be avoided, and, more important, the Department would have available the means of mobilising the scientific men of the country when any national emergency occurs, whether that emergency be industrial or belligerent.

There have been many calls from those who do not understand the implications of their demand that scientific progress should cease for a season to allow the economic and political forces of the world to catch up with the technical development. By such the activities of the Department stand condemned. But we dare not stop if we would. The industry or country that gives science its head will inevitably win the race for the world's markets. The progress of adjustment may be a little painful at times, but the very painfulness of the process is good for the mental development of mankind and tends to make him more self-reliant—an outstanding necessity of these times.

Some Reflections on Repairs and Maintenance

By "CHEMICAL ENGINEER"

THE term, "repairs and maintenance" is generally used to denote the keeping of buildings, plant and equipment in a good state of visible repair, that is to say, the renewal of broken, worn, or corroded parts, and other similar jobs without which the plant, or part of it, would cease to function. The true meaning however is, or should be, the keeping of the plant not merely running, but in the highest state of efficiency, so that the cost of production may be as low as possible, and this requires the closest co-operation between the production staff and the repair staff.

The latter are not looking for trouble. They are almost invariably shorthanded, and they have enough to do in dealing with actual breakdowns and renewals without keeping an eye on all the lesser details. It is up to the production staff to watch for the first signs of failing efficiency and take steps to put things right before the trouble gets serious. This is often difficult, particularly with continuous processes where access to the plant for interior examination can only be had at long intervals, and when output requirements militate against stopping the plant for repairs.

Measuring Instruments

Meters and gauges, pyrometers, and the like, are essential and invaluable aids to efficient operation so long as they give true indications; but they are one and all liable to get out of adjustment, and then they are worse than useless, and may be a positive danger. Far too little attention is paid in most chemical factories to checking these instruments. The repair shop of even a moderate sized factory should possess a standard weight-controlled gauge testing apparatus, on which all gauges should be tested every few months. In small factories a new gauge for each range of pressure can be kept in the stores, and the working gauges can be compared with these.

Pyrometers need a lot of looking after. Care must be taken to see that the cold junctions are always at the correct temperature, that the length and resistance of the compensating leads is not varied during alterations, and that the indicating or recording instruments are in good order. Where a large number of pyrometers is used it is a good plan to have a service contract with the makers, under which they are regularly overhauled and tested. Failing this the works electrician can be provided with a milli-voltmeter and a salt bath, and the makers will send a man to show him how to do his own testing and adjustments. Steam and other flow meters should also be calibrated from time to time, though they are less liable to get out of order once they have been correctly adjusted.

Boiler House and Steam Supply

There are always plenty of things to see to in the boiler house when one can get the opportunity. There is the sampling of coal. Do you buy your coal on a calorific basis? If not, you should do. Stopping leaks in the settings; keeping the grates, stokers, and combustion chambers in good order, and the flues clean. Then there is that CO_2 recorder; does it work all the time, or only occasionally? Keep an eye on the colour of your ashes; black means incomplete combustion and waste. Is the water softener doing its job properly and regularly, so that you are getting neither scale nor pitting in the boilers? Are your feed pumps, stop valves, reducing and safety valves in good order, and your steam ranges free from leaky joints, and everywhere well lagged?

Steam traps may cause considerable loss of efficiency if not looked after. Above all, avoid cheap ones, and only use thoroughly reliable makes of ample capacity for the peak load on each particular line. One often finds that the size of trap put in is based on the normal condensation, and a by-pass is provided for use during heating up operations, when the steam consumption is much higher. This by-pass sometimes gets left open all the time, with serious waste of steam as a result. With most types of trap one can tell by ear whether they are operating properly; but it is well to fit an open-ended branch with a cock on the outlet side. On opening this for a minute or two it can at once be seen whether any steam is getting by. In steam air-heaters a similar apparatus, a defective trap, or one that is too small, may cause the condensed water to build up in the heating coils and greatly reduce the heating efficiency. If the condense from closed steam heaters is returned, as it should be, to the boiler feed, due precautions should be taken to avoid the possibility of acid or other chemicals getting to the boilers in the event of a leak in the heating coils. It is best, if there is any risk of that happening, to run the condense to a special tank and test it frequently.

Cooling Water

In some factories the quantity of cooling water used is very large, and if it is expensive town water, or it has to be pumped to a considerable height, the consumption must be watched. There should always be means of taking the outlet temperature on coolers and condensers, and this should be kept as high as possible. Plant operators are apt to open out the cooling water valves to full extent, instead of as little as possible. In the winter, when the water is colder, far less is necessary. Go round, therefore, frequently with a thermometer to all outlets and avoid waste.

Inefficient cooling will be caused by scale from hard water and by film of mud from dirty canal or river water. Keep the tubes or other heating surfaces clean.

With regard to electric equipment, modern motors are so reliable that they need little attention, but their life will be prolonged if a few simple precautions are taken. See that oil and chemicals do not get on the windings, and blow out the windings occasionally with a bellows or a compressed air hose to remove dust. Change the oil in the bearing sumps two or three times a year.

It is a useful plan to mark the correct value of each fuse on all fuse boards, and to have a supply of fuse wire or cartridge fuses easily accessible at night, so that any fuse which goes can be quickly and correctly replaced even if no electrician is available. Insulation tests on the wiring should be made once or twice a year, and all lighting conductors should be tested for continuity and resistance once a year. Lighting fitting should be kept in good order, and a record kept of bulb replacements and the average life of bulbs.

Fire Protection

See that all hydrants, hoses, chemical extinguishers, and fire buckets are in good working order at all times. Beware of steam pipes near wood or other inflammable material. Given suitable conditions, a confined space and stagnant air, it is surprising how low a temperature is needed to start smouldering. The writer knows of one serious fire which was started by a steam pipe at 45 lb. per sq. in. pressure. Oily waste or rags take little heating to start them off, and should never be left lying about.

The insurance company should always be consulted regarding fire protection equipment. If a certain standard is maintained a reduction of premium can be secured. It is well also to consult the chief of the local fire brigade and take him round the factory, so that if the brigade has to be called in the firemen know where the water can be obtained, and how the engine suctions can be connected up. Definite rules should be drawn up instructing the staff and men what to do in case of fire.

Keep the factory clean inside and outside. The mentality which permits dirt and untidiness can never be efficient. Have proper place for scrap material, disused plant and refuse, and do not leave them lying all over the place. Make the men in charge of each section responsible for keeping their own section tidy and clean.

Cleanliness in the plant itself is also important. For instance, failure to clean the bottom edges of filter-press plates causes more broken plates than anything else, and may give rise to serious straining of the tightening gear.

Attention to Detail

Do not forget to have crane chains annealed and tested every three years, and keep an eye on the condition of lift and hoist wires. Do not let the riggers use worn-out chain blocks or doubtful ropes. New tackle costs less than a bad accident to plant or men.

Keep all vessels, particularly wooden vats and tanks, well up from the floor so that a man can get underneath to look for leaks, and caulk them if required.

Keep iron and steelwork well painted, especially in the neighbourhood of corrosive liquids and fumes. Stinginess over paint is poor economy, and rusty ironwork looks bad and encourages a general air of slackness, as do broken and dirty window panes. Copper apparatus can be kept smart looking with an occasional coat of boiled linseed oil.

Do not neglect the human side. Provide a changing room where the men can leave their outdoor clothes, facilities for them to have a wash before they go home, and, if possible, provide some sort of a canteen where they can at least make tea and heat up food brought from home.

Repair Shop Equipment

The extent to which equipment for carrying out plant repairs in a chemical factory should be provided will depend not only on the size of the factory, but on the local facilities for getting work done outside. If there is a good engineering works and foundry close to the factory it will probably pay better to send out the larger jobs, whereas if the factory is in an isolated position it must be more self-dependent.

However small the factory it must have a fitting and machine shop. Beside the ordinary hand tools to be found in any fitting shop, pipe bending apparatus and a good set of tube expanders will be required. A lathe, drilling machine, power hacksaw, grinder and screwing machine represent practically the minimum of machine tools, while in larger factories a shaper or small planer, and a radial drill may be added. A testing pump and tank for hydraulic tests is almost essential. There is generally enough work to keep a blacksmith going.

In larger factories, particularly those using much copper or aluminium apparatus, a separate shop should be devoted to this class of work. Welding, for both iron and copper and aluminium, is now extensively used in chemical plant, and one or more good welders with oxy-acetylene, for aluminium and lead burning, or oxy-hydrogen equipment will be found useful. A coppersmith's hearth will be required, and a guillotine shears and set of bending rolls are useful features of a larger shop of this kind. A small platform in one corner, about 14 ft. above the floor, should be provided, from which copper and aluminium tubes can be filled with sand or rosin before bending.

In almost every chemical factory there is enough work to keep at least one joiner at work. A circular saw bench does not cost much, and it saves a great deal of time. In factories where many wooden filter-presses are used, new plates can be made up if a planing machine with special grooving knives is provided.

The works electrician must have a place to keep his apparatus and spares, and in larger factories a well-equipped shop will be justified, where motor armatures can be rewound and practically all repairs to motors, fittings, switches, and instruments can be carried out.

A room should be provided where ladders, painting cradles, ropes, and lifting tackle, jacks, and so on, can be kept in tidy fashion, so that everything needed can be found at once, instead of being left where it was last used.

Cements for Furnace Settings

High-grade Products for Reducing Maintenance Costs

In the erection and repair of furnace settings of all kinds in the chemical and allied industries, "Sairset" high-temperature, air-setting cement, fulfils a definite need. It is resistant to temperatures up to 3,440-3,500° F. (1,895-1,925° C.). Applied after mixing in the proportion of six parts of cement to one part of water by volume, it sets at atmospheric temperature (approximately 70° F.), but the action of heat causes it to sinter, forming a strong protective material having a high glaze. The fusion point of this cement, it should be noted, is higher than that of ordinary cements made from flint fireclays, but it has practically the same physical and chemical properties as the best firebrick, and, in addition, is almost free from expansion and contraction. These good qualities are said to be due to scientific control in all stages of production, the raw materials being carefully selected and blended to ensure uniformity.

Combustion Chamber Brickwork

For surfacing combustion chamber brickwork, whether new or old, two or three coating are recommended, giving a total thickness of between 1/16 in. to 3/32 in. This can be applied either with a brush or by cement gun, and approximately five hours are required to mature the first coating; subsequent coatings requiring a somewhat shorter period in which to dry out. When employed for bonding in the laying of firebricks, the cement after burning has a transverse breaking strength of well over 1,000 lb. per sq. in., forming a highly efficient, dense, and hard joint, which offers strong resistance to the destructive effects of slagging, as well as erosion. Another application is found in the "pointing" of holes and cracks.

The value of this cement for extremely difficult working conditions, including the presence of acid, was demonstrated at a large oil refinery having eight steam boilers. Here, the fuel used was a mixture of 50 per cent. heavy oil and 50 per cent. acid sludge (the residue formed on washing the oil fractions with sulphuric acid), together with a considerable amount of gas, and the plant was often operated at considerably above its normal capacity. Because of the excessive local temperatures, as well as the presence of moisture and acid fumes, and the slagging action of the impurities in the heavy oil and sludge, the brickwork of the furnace deteriorated rapidly. An effective remedy, however, was found in a mixture of "Sairset" and calcined grog, made into a soft mud and used for pointing the walls, followed by covering the interior surface with the mixture by means of a spray. As a result of this the furnaces operated without any further difficulty for a period of four years.

Industrial Applications

Typical industrial applications of "Sairset" are boiler plant combustion chambers of all kinds, for solid, liquid, and gaseous fuel firing, as well as waste heat. In the chemical industry the cement is also being used for heaters, evaporators, distillation plant settings, acid towers, muffles and heat treatment furnaces. Another important field is found in the iron and steel as well as non-ferrous metal industries, for soaking pits, roasters, reverberatory furnaces, cupolas and annealing furnaces. Mention may be made also of rotary lime kilns, cement plant, gasworks retorts, and high temperature carbonisation settings, glass melting pots, and muffle furnaces for enamelling. Another interesting product for reducing maintenance costs in furnace settings of all kinds is "Quik-Pach," also a production of Steam Plant Accessories, Ltd. This material may be described as one giving "first aid" for furnace settings. It is supplied in drums as a stiff paste of the consistency of putty, and is used for the rapid repair of holes, crevices, and bad patches, even of very large size, in firebrick linings and ordinary brickwork. The product is changed by the action of the heat to an extremely hard and resistant product, with almost negligible shrinking.

Art Competitions in Industrial Design

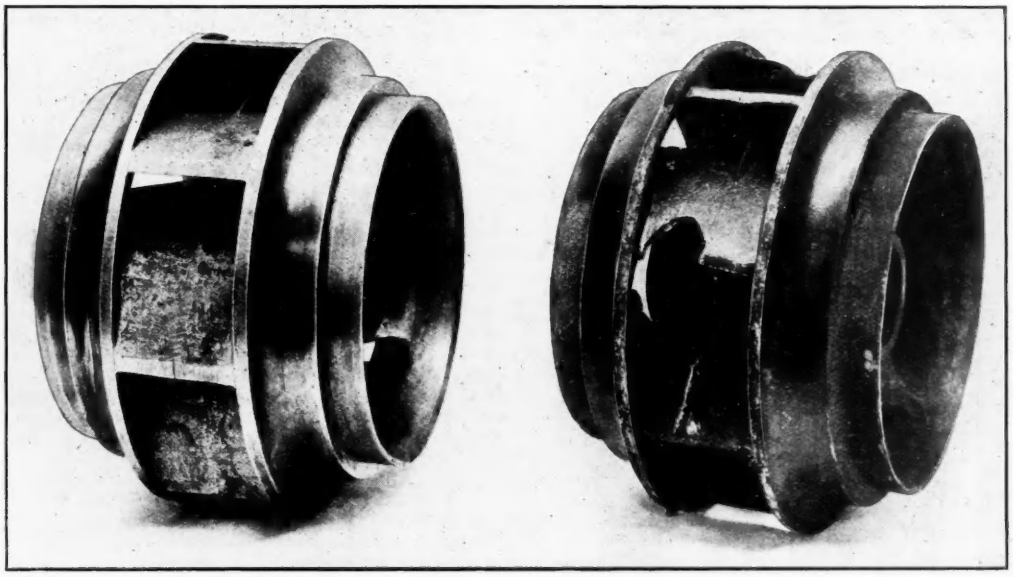
Particulars of the tenth annual open competition of industrial designs, to be held at the Imperial College of Science and Technology, Imperial Institute Road, South Kensington, London, S.W.7, in June, 1933, have now been issued, and can be obtained from the Secretary of the Royal Society of Arts, John Street, Adelphi, London, W.C.2. Intending competitors must apply to the secretary of the society between May 1 and May 8, for the necessary entry forms, the last day for receiving entries being May 20. The designs will be received at the Imperial College of Science and Technology between June 6 and 8. In all, scholarships and prizes amounting to about £1,500 are offered in connection with the 1933 competition.

Stainless Steels for Chemical Plant

Eliminating Corrosion and Reducing Maintenance Costs

THE last decade has seen considerable advances in the development and improvement of corrosion-resisting steels, but, of equal importance, it has seen a very large extension of the application of these special steels in numerous branches of the chemical industry. It is true to say that the modern chemical engineer owes much to the metallurgist, as the discovery, development, and production of corrosion-resisting steels have given the chemical engineer a wide scope for the application of steel to the chemical industry, thus giving greater latitude and flexibility in plant and processes than hitherto, and, at the same time, providing a material capable of combating the chemical engineer's deadly foe—corrosion.

Prior to the advent of the modern corrosion-resisting steels, the chemical engineer had for many purposes to resort, on the one hand, to the use of enamelled linings, ceramic materials, concrete, soft metals (such as lead), vulcanite, etc.; on the other hand he had the choice of ordinary steel and cast iron. Whereas the enamel linings, ceramic materials, lead, etc., probably enabled him to manufacture certain chemical products with a reasonable degree of purity, the limitations of size and shape of plant and items of equipment necessarily imposed by the use of such materials naturally added to the engineer's difficulties in addition to retarding progress and output. Again, if for certain purposes the chemical engineer was desirous of departing from the use of either of very fragile materials, or of soft metals with their low mechanical strength, and used, say, mild steel so as to have greater strength and ductility, at the same time having a greater choice as regards method of fabrication and size and shape of plant, he often did so at the expense of contaminating the chemical product he was manufacturing.



Staybrite and Ordinary Cast Steel Impellers. Both have been run at 1,400 revolutions per minute, 144 hours per week for two years, pumping water containing sediment, grease and acid.

Increased Life of Plant

The latest corrosion-resisting steels have provided the chemical engineer with not only one, but a variety of steels having excellent mechanical properties, combining strength with ductility, resistant to a wide range of corroding media, capable of being manipulated and fabricated in the majority of ways applicable to ordinary mild steel, and last, but not least, available in practically all the forms in which ordinary steels are obtainable. The well-known Staybrite steels (sometimes known as the 18/8 steels) containing 18 per cent. chromium and 8 per cent. nickel, with the additions of other special elements, are the steels which are being applied most extensively to combat corrosion, not only in the chemical industry, but in numerous other industries. From the composition of the steels in question, it will be realised that they can never approach ordinary steels in price, and whilst the price of these special steels has been materially reduced during the last few years as a result of increased output resulting from extension of their application, they must of necessity always be considerably dearer than ordinary steels. The somewhat high initial cost of corrosion-resisting steels is likely to act as a deterrent to their use unless the advantages accruing from their application are really balanced against their initial cost. In these days of economy there is a danger of considering first cost only, instead of weighing up advantages such as increased life of plant, better product, less maintenance and repairs, fewer shut-downs and bigger output. Nevertheless the wise chemical engineer is not slow to appreciate the real worth and value of corrosion-resisting steels, as is evidenced by their increasing application.

The excellent resistance of Staybrite steel to nitric acid has resulted in the extensive use of this steel both in this country and abroad, in the production of nitric acid by the oxidation of ammonia. Larger oxidiser cooler units, absorption towers, and storage tanks, as well as pumps, valves, pipe lines, etc., are giving excellent service, whereas the transport of strong nitric acid is rendered easier, safer, and more economical as a result of the use of Staybrite steel tank wagons and drums.

Increased Purity of Product

In the production and storage of fine chemicals and pharmaceutical products it will be appreciated that purity of product is the prime consideration, and this is dependent to a considerable extent upon the resistance to corrosion of the vessels in which the products are manufactured and stored. As a result of careful investigation into the possibilities of the use of a number of different materials, the modern factory of one of the largest manufacturers of pharmaceutical products now in Europe is now equipped with steam-jacketed pans, mixers and storage tanks constructed in Staybrite steel. This is an outstanding case where the advantage of the use of Staybrite, as regards increased life of the plant, and freedom from repairs, is supplemented by increased purity of product.

The use of Staybrite steel in the dyeing branch of the textile industry is an instance where considerable economies and increase in efficiency have accrued. The use of this steel

instead of wood and non-ferrous metals and alloys, gives increased life of the plant, reduces the loss of time due to frequent repairs, eliminates damage and staining of fabrics, and enables the changing of colours to be carried out in the same vats with rapid sequence. Moreover, its use has assisted in the development of newer and delicate shades.

Reduced Maintenance Costs for Pumps

In the manufacture of copper and nickel sulphates, Staybrite steel has replaced regulus metal in some parts of the plant, and in other parts of the plant large filter presses in Staybrite are dealing satisfactorily with the sulphuric acid solutions. For many types of valves, stainless steel has also proved a boon. In one particular case, both stainless steel and brass valves were fitted to certain feed pumps dealing with treated water, and after 6,000 hours the stainless valves were still perfectly satisfactory, the brass valves having corroded severely. In another case, stainless steel hydraulic pump rams were fitted in 1926 and were stated to have saved their cost on the packing bill alone, apart from the fact that ordinary pump rams only last some 6 months.

In the sugar industry, the use of Staybrite and stainless steel is effecting considerable economies. For example, pump rods for hydraulic pumps, driving centrifugals, have been working for at least five years, with no sign of wear or corrosion, whereas ordinary rods needed replacing every year. At the same factory, Staybrite steel duplex pump rods are

Three Staybrite and two Tinned Steel Steaming Cans for the Textile Industry; after two years' service the Staybrite steel remained satisfactory, but the tinned steel was ready for the scrap-heap, the boring having been repaired four times

giving excellent service handling sugar cane juice and the authorities state that stainless steel has proved most economic for all pumps dealing with sugar cane juice.

Reduced Risk of Discolouration

It is interesting to know that there are actually cases where stainless steel has proved superior to materials which are intrinsically more expensive than the stainless steel, a case in point being the replacing of platinum by Staybrite steel, for the production of silver nitrate. In the moulding of synthetic resin powders the colouring matter often has a discolouring effect on the finished product when moulded and pressed in dies made from ordinary steel. This has been obviated by the use of stainless steel moulds or dies, and moreover, the use of such dies allows the finished product to leave the die without sticking. Staybrite steel has also replaced copper for stills for dealing with essential oils, the life of the stills being increased thereby, as well as the product being improved. In the melting of gums, such as Congo copal, in the manufacture of varnish, the colour of the gum is easily ruined by slight solution of the metal of the containing vessel. In an actual case, copper had to be resorted to on this account, but soon wore out with constant stirring. Experiments with Staybrite showed it to give a gum of excellent quality, whereas ordinary steel rapidly ruined the gum, making it opaque.

The paper industry has also taken advantage of the use of Staybrite steel. An important paper mill in this country is using refiner or beater bars made of Staybrite, and the life obtained from these blades as compared with phosphor bronze is such that it is proposed replacing other materials with Staybrite steel. Over a period of several months, Staybrite bars scarcely showed any signs of wear or corrosion, whereas bronze bars wore on the working edge approximately 3/16 of an inch, such appreciable wear necessitating frequent resetting of the blades with consequent interruption of working. Staybrite steel is also being satisfactorily used for dealing with sulphite liquors in the digestion of paper pulp.

The application of stainless steel to turbine work is well-known, many tons of stainless steel blades replacing nickel steel and bronze blades, and it is very illuminating to inspect stainless and nickel steel blades, which have been working side by side for many months in the same turbine. Staybrite steel shovels have proved excellent and economical in dealing with copper sulphate, some of these shovels being still satisfactory after two years' service, and having outlived fourteen handles.

In the food industry increasing attention which is being given to the question of the presence of and effect of copper on numerous foodstuffs. Closer scrutiny and restrictions are being applied in this direction, and Staybrite steel is replacing copper in many branches of the industry on account of freedom from copper contamination.

Research on the Railways

L.M.S. Reorganisation

PROGRESS in the application of scientific research to the operation of British railways was reviewed by Sir Josiah Stamp, chairman of directors, at the recent annual meeting of the London Midland and Scottish Railway Co. Shortly after the last annual meeting, at which he spoke of the reduction in working expenses which had been brought about as a result of research, he said, papers on various aspects of scientific research by the three vice-presidents of the company were published, and copies were in request from all parts of the world. A high official of one of the railways abroad remarked that "England may well be proud of the achievements of the L.M.S. Railway as recorded in the pamphlet—they constitute a splendid tribute to modern railroading."

Sir Josiah Stamp said all the company's laboratories had now been brought under one control, and the reorganisation would enable the company still further to take advantage of the generous assistance of its advisory committee on scientific research and ensure that the results of research work were translated into actual practice with the least possible delay.

A new method of cleaning carriage stock, which had been evolved in the paint laboratory, made it possible to cut down the number of coats on new carriages from 17 to 9, and also secured a longer life for the paintwork. Fuller utilisation of scrap in place of virgin metal had been achieved in the company's foundries. Research carried out in the metallurgical laboratory had developed means for renovating scrap, which had enabled them to raise the quantity of scrap used in the manufacture of rail chairs to 90-95 per cent., and similar successes were being obtained in the case of axle boxes, cylinders, brake blocks, etc.

Improved thermal efficiency of the locomotive boiler under actual running conditions had been obtained. Novel methods had been developed for measuring the various heat losses which occurred, and from the results it was expected that means of reducing the losses would be forthcoming. A further investigation bearing on coal consumption had been carried out for the company at the National Physical Laboratory in co-operation with the London and North Eastern Railway. With the aid of small-scale models the air resistance of each vehicle in a train had been determined, and they were now studying how to modify the design to reduce resistance due to motion through the air. He claimed that this investigation formed the most complete study of the problem so far undertaken.

Welded Plant in the Chemical Industry

By HARTLAND SEYMOUR

READERS of technical journals devoted to the various branches of the chemical industries during the past few years must have noticed that many manufacturers of equipments for these industries stress the fact that their products are welded; others announce that they are prepared to fabricate welded equipment to specification. In addition, announcements of the new special metals and alloys developed to resist the effects of corrosion and high temperature almost invariably include a statement as to weldability in discussing their important characteristics. There is probably no greater field for welded plant than in the chemical industries, for an almost infinite variety of solid, liquid and gaseous materials must be handled and treated under widely varying conditions of temperature and pressure. For all these operations leakproof joints are essential. For cast iron and steel, welding technique has long been developed. Much chemical plant, however, is now being made from special metals and alloys, such as aluminium, copper, nickel, monel metal, aluminium bronzes and the recently developed rustless irons and stainless steels. The latter are also resistant to oxidation even when heated red hot, and are widely used for reactions requiring high temperatures. The fact that all of these metals and alloys can be readily welded by either the arc or the oxy-acetylene process is an important factor in facilitating the fabrication of chemical equipment.

A wide variety of standard chemical equipment is now being manufactured. For example, for the processing, storage and transport of food products, pharmaceuticals and fine chemicals that would be contaminated by contact with metal, enamel-lined plant is widely used. The steel base to which the vitreous enamel is fused is made with welded joints. Other standard equipment made by welding included such plant as heat exchangers, condensers, stills and jacketed kettles, including those of copper, nickel and Monel metal, indirect heating systems using hot oil circulation, jacketed piping, storage tanks, drums and other containers. Welded construction is also being used for a wide variety of processing plant. Among these are absorbers, condensers for working at high pressures (600 lb. per sq. in.), stills, autoclaves, scrubbers and fractionating columns.

Pipework and Special Plant

Many chemical works require special plant which can be designed by the engineers on the works. Some of this can be made in the shops where welded plant is used, though much of it, naturally, will have to be obtained from contractors. Typical of the work which can be done by the works own welders is the erection of various piping systems. For example, the ideal design for welded piping to carry chemical products would specify that every possible joint be welded, making the system practically one-piece construction. There are many practical considerations, however, which make it necessary to modify this ideal design. In many cases it is necessary to clean out lines at specified intervals. In other cases the piping system may convey inflammable gases or liquids so that the method of employing an electric arc or oxy-acetylene flame is impossible. Here the welded pipe line can be welded up in sections and then joined with flanges. In designing special plant the works chemical engineer may require the services of a capable welding engineer so as to make sure that his designs are practicable from the point of view of the fabricating shop. Examples of this have been found in several pressure vessels which have been built recently. In one case the problem was to provide storage for large volumes of certain materials at approximately 300 lb. per sq. in. The engineers of a manufacturer of electrodes were consulted and as a result a satisfactory welding procedure was established. Another example is provided by an exhaust steam header for a group of compressors. This was welded and the entire header was fabricated and dispatched in a single piece 56 ft. long.

A special feature of welded piping is the ease with which special fittings can be made up from standard pipe. This is particularly important in chemical plant work, as the piping is of necessity very complicated. As an example, it was necessary to connect three large welded absorbers to that they could be operated in various combinations of series or parallel connections. The special fittings necessary were easily made by the welding shop. Other points where welded construction has greatly simplified piping are found in connection with special compressor installations and in the control boards for operating various types of equipment. A chemical works welding department can also make up the various headers, coils, scrubbers, traps, drips and similar items that are required in large numbers in every chemical plant. In addition to work on equipment and piping, the welding shop can also make up a large variety of what might be termed "accessories," such as supports for tanks and coils, pipe brackets, pipe supports and hand rails.

The Welding of Stainless Steels

One of the most interesting of the new metals is stainless steel, which has developed considerably during the past few years. Where some five or six years ago, the 12 per cent. Cr. steel was mainly used, to-day the 18 per cent. Cr., 8 per cent. Ni. steel is the principal type used for all tanks and chemical plant. This latter type of stainless steel is now marketed under names such as Staybrite, Anka, Maxilvry, etc. Such steels are of the austenitic type, *viz.*, they contain nickel-chromium carbides in solid solution. Until quite recently these steels were susceptible to "weld decay," that is, the steel when heated to about 700° C. suffers from loss of resistance to corrosion, so that a weak zone occurs near the weld. This was caused by precipitation and segregation of the carbides at the grain boundaries and could only be cured by a subsequent heat treatment after welding. Recently, however, these steels have been improved by the addition of suitable alloys which prevent "weld decay," and heat treatment after welding is now unnecessary.

The welding of stainless steels, however, has now been thoroughly studied, and what is known as the Quasi-Arc stainless steel electrode has been produced. This is not only easily applied but also deposits a metal that is of the 18 per cent. Cr., 8 per cent. Ni. composition, capable of making a perfect junction with the steel. The electrode incorporates a special flux which prevents oxide from entering the weld metal, the result being that the weld is clean and has a resistance to corrosion equal to that of the parent metal. Further, special alloys have been added to the electrode, which prevent "weld decay" from occurring in the weld metal. With such an electrode, reliable welds can be obtained with most commercial types of stainless steel, particularly those of the nickel-chrome variety. Such electrodes can also be usefully employed for reinforcing other steels with a layer of stainless steel, an application which is likely to prove of value to the chemical industries. By this means a stainless steel layer can be obtained of about 1/10 in. or thicker, as required. Typical instances of such applications are the reinforcement of pump spindles and valves. By the addition of this surface layer the life of such parts under corrosive action is greatly increased, so that the plant can be operated over a greater period and its efficiency maintained. The stainless steel electrode can be used for welding stainless steel to mild steel as in the case of high pressure steam valves, etc., but where a stainless weld metal is not required, the uranium electrode may be used for this purpose, as in the case of welding mild steel water jackets to stainless steel vessels for processing equipment.

Increased Use of Aluminium Plant

Sheet aluminium is coming into greater us for chemical plant. Sheet aluminium is the commercially pure metal, while cast aluminium is alloyed with an appreciable percentage of other metals. The rolled metal never contains more than 2 per cent. of other metallic ingredients and frequently less than 1 per cent. The chief impurities in aluminium sheet are iron and silicon, but these do not appreciatively affect its welding qualities. The high rate of thermal conductivity and very low fusion point of aluminium are characteristics which must be studied by the inexperienced welder. The

aluminium oxide film has a higher melting point than the aluminium and therefore without proper fluxing this oxide film holds the molten aluminium until either the film melts or the molten aluminium ruptures the film, making it difficult to tell when the melting point has been reached. This makes it necessary for the operator to develop a technique somewhat different from that employed in welding steel. A good grade of aluminium flux should be used to remove the oxide which forms readily on the surface of molten aluminium. True fusion takes place only after the flux has been applied, removing the oxide.

Lead Tanks for Acid Storage

Lead is also used extensively in many chemical plants, particularly those manufacturing sulphuric acid. In certain branches of the industry the oxy-acetylene welders are required to handle lead as part of their regular work. In several large paper and pulp mills the welders have become very expert in fabricating flanged lead piping and special fittings used for handling sulphur dioxide and for constructing the blow-off lines from the sulphite digesters. Light lead sheets can be gas welded without requiring a rod, but for most work a rod is required, and this can be obtained by cutting strips from sheet lead.

The case of a chemical works which had to make several small tanks for storing sulphuric acid was reported in a recent issue of "Oxy-Acetylene Tips." These tanks were covered with steel shells to support and protect the soft lead lining. One such tank, used to collect acid fumes prior to dispersal through a ventilating chimney, was constructed in this manner. The inner lining was made up of 3/16 in. sheet lead. A 3/16 in. steel shell and stand were also fabricated by gas welding. The piping for this tank, as well as over 10,000 ft. of pipe used in connection with the alcohol extractors, was all fabricated by welding. Sheet lead was rolled to the required thickness, and then the longitudinal seams were welded. After this lead piping was welded in place, an angle iron framework made up in halves by welding, was bolted around the lead pipe, to act both as a support and as a protection against injury. The welding shop was also called upon to fabricate a lead-lined valve for use in connection with this lead piping. Using an oxy-acetylene lead welding blowpipe, lead was applied to all inner surfaces, until the entire inside of the valve, in both open and closed positions, had a solid lead lining. The unique part of this job was that a lead-lined valve of the type desired could not be obtained ready-made and it was necessary for the works welder to do the entire job himself.

Monel Metal and High Nickel Alloys

Monel metal is an alloy of nickel and copper with small amounts of other elements, such as iron and manganese, and is particularly suitable for certain types of corrosion-resisting equipment. Strips cut from the sheet can be used as welding rod, if cold-drawn monel metal wire is not available; usually a little flux will be found helpful to the welding operation. As the welding starts, a skin of oxide and slag forms on the surface of the molten metal. This is of advantage in protecting the metal underneath from further oxidation. For this reason the welding rod should always be applied and melted under this oxide skin, and any dirt or other foreign material should be worked up into the slag.

Oxy-acetylene welded joints for high nickel alloys was recently discussed in a paper by Flocke, Schoener and McKay at the annual convention of the International Acetylene Association. The three alloys considered were Monel metal, pure nickel, and Inco chrome nickel. The first two are the most commonly known and widely used of the high nickel alloys, while the last is a recently developed metal having a superior resistance to tarnish or stain and somewhat higher physical properties than pure nickel. Each of the three alloys has a definite place in the chemical industry and each is used in a wide variety of conditions. Monel metal is resistant to both acid and alkaline corrosion, as for instance in salt dryers, dye tanks, stills, retorts and condensers, extractor baskets in ammonium sulphate manufacture, drying trays in manufacture of dyestuffs and pharmaceuticals, rubber latex spraying equipment, abbatoir equipment such as oleo melting kettles, and innumerable pieces of chemical engineering equipment. Nickel, while slightly less resistant to acids is very resistant to alkalis and to a wide range of salts. The most important application of nickel lies in caustic and food product evaporators in which the tube sheets, tubes and downtakes are of pure nickel with the body of nickel-clad steel. Pure nickel also finds application in the ammonia oxidation process in the manufacture of viscose and cellophane and in the manufacture of photographic emulsions. Steam-jacketed kettles of nickel are a standard item for the food industry as are pure nickel brine and syrup tanks. Inco chrome nickel is particularly useful in handling foods and milk products because of its high surface resistance which parallels that of the stainless steels rather than nickel or Monel metal.

Fluxes and Welding Rods

The oxy-acetylene welding of nickel and Monel metal has been practised for more than a decade quite satisfactorily. It has been and is being used successfully in the fabrication of all types of equipment in the chemical field as well as in many applications other than those in the chemical industry. Improvements in recent years, both in fluxes and welding rod, have aided in the advancement in the welding of high nickel alloys. In the main, the oxy-acetylene welding of the three high nickel alloys is much the same, with only minor variations. These are all strong alloys, rather stronger than common steels. There is, however, a peculiarity manifested in high nickel alloys that is perhaps not nearly so marked in other metals though present—a range of low tensile strength and brittleness, between the temperatures of 1,450 to 1,650° Both above and below this "hot-short" range they regain their normal strength and ductility. For this reason expansion and contraction must be taken into account, to see that there are no undue stresses set up or existent while the weld metal and immediately adjacent metal are passing through that hot-short range as the weld is cooling.

Letters to the Editor

Sir Robert Witt on Personnel

SIR,—I have read with great interest your remarks, under "Notes and Comments," on the need for definite selection of personnel and research into methods of distribution. The importance of having the right man in every job needs, surely, no demonstration. The obvious method of getting the right man is to analyse the abilities and qualities required by the job; and then to discover whether the man whose appointment is contemplated possesses those abilities and qualities. If he does, then there is every reason to suppose that he will be successful and happy at his work; if he does not, then he will not be able to succeed in it—and an unsuccesful man is rarely a happy one.

The problems involved in occupation analysis and in the assessing of an individual's abilities are essentially psychological problems. They are problems to which industrial psychologists have devoted a great deal of attention. And the results obtained in this work during the last twelve years by the National Institute of Industrial Psychology abundantly prove that their efforts have not been wasted.

Distribution and marketing, also, abound in psychological problems. The reasons why people buy one product instead of its competitor are usually complex and elusive—even the purchasers themselves cannot always say why they prefer so-and-so's goods. It is necessary to obtain the information by indirect means. It is necessary to have a thorough understanding of motives and the psychological factors which can influence such a decision. And here again, the results of the industrial psychologist's work demonstrate that he has a very real contribution to make to industry.

"There are signs," you say, "that the value of investigations upon the human raw material is being recognised in industry." That recognition is growing rapidly. And none who have seen the results of such investigations can doubt that their extension must result in very real benefits for industry and for all who are engaged in it.—Yours faithfully,

ROBERT WITT,
Acting Chairman.

National Institute of Industrial Psychology,
Aldwych House, London, W.C.2.

Oxy-Acetylene Welding and Metal Cutting

How it is Serving the Chemical Industries

METALLURGICALLY, the outstanding feature of modern practice in chemical works is without doubt the extensive use to which vessels of corrosive resistant alloy steels are now being put. Fortunately, chromium-nickel austenitic steels and cupro-nickel alloys are highly suitable for welding, and it has become standard practice in British chemical works to take advantage of this fact, and to make the many varieties of vessel required in such metals by means of welding, both the blowpipe and the electric arc being used, the former upon material of $\frac{1}{8}$ in. section and less, and the latter upon material over $\frac{1}{8}$ in. thickness.

In the chemical industry generally oxy-acetylene welding is used in the manufacture of apparatus of chromium-nickel steels, and on mild steel parts up to 10 s.w.g. material. General practice is to employ the electric arc on mild steel of heavier s.w.g. than 10 in most cases, though occasionally the blowpipe is used for heavier sections. In copper oxy-acetylene welding is found on sections of metal from 12 s.w.g. up to $\frac{1}{2}$ in. thickness, employing only deoxidised copper for both parent metal and filler material. In aluminium, welding is mainly upon 12 and 10 s.w.g. sheets, but occasionally aluminium welds are made up to $\frac{1}{2}$ in. thickness. Some use is found for nickel and Monel metals, and although these materials are not in such common use as mild steel and steel alloys, copper and aluminium, when they are welded the oxy-acetylene system is used. In metal-cutting, only the hand oxy-acetylene system is employed; on mild steel flanges, and in cutting away defective or failed mild steel plants, etc.

In one of the larger works of an important chemical manufacturing concern, all welded parts which fail in service are submitted to the metallurgical department for examination. As a result of this examination, a decision is made as to change in design, method of welding, or suitability of certain welders for the work they are doing. When a big job has to be done, the men concerned send sample welds to the research department, which are tested, microscopically and physically. The methods of the men are then approved or not, according to the result of the examination. Welding equipment, particularly that relating to the welding of special materials, is continually being checked. All material to be welded is bought to a definite specification.

Maintenance and Repairs

In another works which started with two welders in 1922, there are now employed upon whole-time work 40 oxy-acetylene welders and 17 electric arc welders; some of these welders can operate with both types of plant. When the large construction programme drew to a close, welding for constructive purposes was naturally less than it was, say, a year previously. For repair work, however, there is still a steady demand for welding. In the platers' shops, mostly electric arc welding is used; in the sheet iron workshops, mostly oxy-acetylene welding is used; *in situ*, both processes are employed; and in the plumbers' shops, some oxy-acetylene welding is used with a great deal of oxy-acetylene lead burning.

In contrast with this works there are some companies of chemical manufacturers which, not large enough to undertake manufacture of their own plant, nevertheless find a use for oxy-acetylene welding and cutting in maintenance and repair work alone, sufficient to employ one or two whole-time welders. In most of such cases the operator employed is able to accomplish sound work in both oxy-acetylene and electric arc welding, and must necessarily be something of a jack-of-all-trades. Generally he will be found to be a very intelligent blacksmith or boilermaker who has mastered the elements of welding with both processes, and can execute reasonably good work on mild steel with either process. The work he does is mainly upon steam main and oil-pipe lines, welding on flanges, making water-tight joints on steam coils, cutting patches for stove boilers, repairing pipe-lines, and similar maintenance work. In these cases one may safely assume that the value of oxy-acetylene and electric arc welding in production work is not appreciated as it should be, but that, a beginning having been made in repairs, the time will duly come—and quickly—when, under stress of competition, welding and metal-cutting will be given their rightful place in manufacture as well as in repair.

Chemical Plant Manufacture

The larger companies of chemical manufacturers maintain their own workshops in which plant is produced for their own purposes, but even these occasionally make use of outside manufacturing companies specialising in the use of such plant, especially when, as sometimes occurs, such outside manufacturers are the owners of patented apparatus which it is desired to use. Smaller companies rely entirely on the work of the chemical plant manufacturer, who is a specialist, among other things, in the working of alloy steels, copper and copper alloys and of lead, nickel, aluminium, etc.

Most British chemical plant manufacturers, of whom there are some scores, tend to specialise in the making of plant for a particular industry, of which we may take soap manufacture as an example. The soap manufacturer requires tanks, chemical vessels, jacketed pans of various kinds, small boilers and heaters, among other requisites, for his industry. Some of these are wanted in mild steel, others in cast iron, copper, or stainless steel. His supplier uses oxy-acetylene welding in the manufacture of most of them, and also, when called upon to make repairs *in situ*, he will use a portable oxy-acetylene plant. Welding in the production of such vessels has taken the place of flanging and riveting, with the result that a cheaper and very definitely neater job is produced. In some of these factories a modified system of procedure control is practised, particularly as regards the work of individual welders which is from time to time subjected to breaking strain. Hand metal-cutting is generally in use on mild steel up to $1\frac{1}{2}$ in. thickness, and occasionally on internal renewals or repairs in shafting up to 3 in. diameter.

Beet Sugar Factories

At beet sugar factories the building up of worn shaft journals, broken gear wheel teeth, repairs to sheet metal chutes, floats, guards, and other sheet metal articles, repairs to broken or damaged castings, and, in plant maintenance, the welding on of pipe flanges, are all dealt with by means of the oxy-acetylene blowpipe. Steel, brass, copper and cast iron are all dealt with from time to time, and in some cases aluminium. In the large factories two or three welders are kept in whole-time employment, and the oxy-acetylene system is mainly in use, though for pipe flange work it has in one instance been replaced to some extent, *i.e.*, on pipes of heavier section, by electric arc welding. Hand cutting is in use upon plates for repairs to machinery and for cutting beams and channel irons in structural building work within the factory. In one case welding repairs were initiated in a beet sugar factory as long ago as 1912, but in most of them it is a post-war development.

Plant production work at artificial silk factories is in the making of steel, aluminium, bronze, and copper utensils. Repairs and maintenance include the cutting of girders, repairs and extensions to steam and water pipes, and the repair of broken castings and machine parts. In one large company the work has increased since 1923, when they employed one welder, to such an extent that they now have eight full-time men at work, including three coppersmiths, who have specialised in copper welding. Where possible, all welded work is hydraulically tested to 300 lb. pressure per sq. in., a point well beyond the working pressure. Oxy-acetylene hand cutting is in use for the usual purposes.

Oil Refineries

There are not very many oil-refining companies in Great Britain, but they all employ oxy-acetylene equipment for plant maintenance and repairs, and the following history of the progress of one of the more famous of these companies can be taken as typical of the use which this industry makes of the blowpipe. In this case welding and metal-cutting are in use at four oil storage installations for the erection and repair of pipe-lines, steam coils, steel joints, lead linings, and in the manufacture of any special fittings which may be required from time to time.

Petroleum as a Source of Paint Materials

Solvents, Diluents and Thinners

PETROLEUM as a source of paint materials was the subject of a paper read by Mr. C. I. Kelly, assistant chief chemist to the Anglo-American Oil Co., Ltd., at the monthly meeting of the Oil and Colour Chemists' Association, held at the Institute of Chemistry on March 9, when the chair was taken by the president, Mr. J. F. C. Wilkinson. Mr. Kelly dealt with his subject in a comprehensive and systematic manner, and after making brief reference to the production of asphalt and carbon black he passed on to consider hydrocarbon solvents, diluents and thinners. He said that literature of recent years had devoted much space to the comparison of white spirit and turpentine as thinners, the primary aim being the adulation of the latter. In spite of this, the paint trades in this country, the Continent and America continue to consume increasing quantities of white spirit, for its superiority over turpentine lies in (1) its uniform quality, (2) its stable white appearance, (3) the absence of any tendency to "go-off" in storage, (4) its ready availability, and (5) its low price.

Objection has been made against petroleum naphthas as diluents on account of their solvent powers being less than corresponding coal-tar fractions, and because their evaporation rates used to decrease rapidly with time. The latter deficiency has been successfully eradicated by decreasing the distillation range and by using more efficient fractionation equipment. This development has assisted in increasing their solvent properties in as much as the hydrocarbons in them boil more closely to the boiling points of the aromatic hydrocarbons found in these fractions. Still further improvements have been made by careful selection of light and heavy naphthas from crudes containing the most aromatic hydrocarbons that was possible only after an extensive study of the chemical composition of crude oils had been made. The usefulness of such products could be increased still more, by narrowing down the boiling range about the boiling points of the aromatic hydrocarbons or their constant boiling point mixtures with the other hydrocarbons present, as done during the war when aromatic hydrocarbons were needed for explosives manufacture. This procedure is, however, not a practical solution for it would mean curtailment of supplies and increased prices. The most satisfactory solutions lie in (1) the synthetic production of aromatic hydrocarbons from petroleum, and (2) the manufacture of high solvency naphthas by the hydrogenation of petroleum.

Products from Cracking Reactions

Almost any petroleum fraction when cracked at suitable temperatures will yield aromatic hydrocarbons, ranging from benzene to the polynuclear hydrocarbons (naphthalene, etc.). The most suitable starting material from most points of view, however, is natural gas and refinery gases, which are being produced in ever increasing quantities; they are cheap and new outlets for them are sought. The extensive research work with the simpler hydrocarbons has demonstrated that methane is the most refractory, which is unfortunate because it forms the largest part of natural gas. Refinery gases, therefore, seem to be more suitable since they contain larger amounts of ethane, butane and propane all of which are much more amenable to treatment than methane. When these gases are violently treated at temperatures between 700 and 1,100° C., they undergo cracking reactions yielding olefines which polymerise into benzene and its homologues, some higher aliphatic hydrocarbons being produced as well. Yields of approximately two gallons of benzene per thousand cu. ft. of gas have been claimed. The main factors in the process are temperature, pressure, and time of contact with the heated zone, the tendency being to work at atmospheric pressure and to select the best temperature/time of contact ratio for the gases used. This method of manufacturing aromatic hydrocarbons for general use does not appear to have been established commercially, but it is understood that full scale plants are being operated in Persia and that a semi-scale plant has been built in America.

Hydrogen is made by a continuous process from natural gas or refinery gases which are mixed with steam and passed through catalysts in tubes heated to about 1,600° F. The carbon monoxide and hydrogen formed are mixed with more steam and contacted with a second catalyst at about 850° F. The carbon dioxide so produced (approx. 20 per cent. of the mixture) is removed by triethanolamine in a scrubbing tower operating under a pressure of 250 lb. per sq. in. The gas leaving the scrubber (97 per cent. hydrogen) is compressed to 3,000 lb. per sq. in. and mixed at that pressure with selected low-aniline-point gas oil. Having been raised to 700° to 850° F., the reactants are passed into chambers filled with sulphur-resistant catalysts. There, the exothermic reaction raises the temperature to 750 to 1,000° F. or more if desired. After cooling, the liquid reaction products are separated from the gas under the full pressure of the system and subsequent fractionation of the liquid yields the hydrogenated solvent naphthas.

Hydrogenated Solvent Naphthas

The following table enables one to compare the solvent powers of an hydrogenated solvent naphtha, a petroleum product (normal) and a coal tar fraction, all being of approximately the same boiling range :—

	Hydrogenated Solvent Naphtha.	Normal Petroleum Naphtha.	Coal Tar Naphtha.
Sp. gr. at 60° F.	0.8676	0.7715	0.859
Aniline Point, °C.	−28.3	64	8.3
Initial Boiling Point, °C. ..	145	155	150
Final Boiling Point, °C. ..	211	212	192
Kauri Butanol Value* ..	77	30	72

* Denotes the amount of the solvent naphtha which can be added to a standard kauri gum solution without coagulation.

Four hydrogenated naphthas having graded evaporation rates favourably their use in different types of coating compositions can be produced, the respective boiling ranges being 200-275°, 275-365°, 365-419° and 419-550° F. Of these, the more rapidly evaporating grades would be selected for lacquers, whereas varnishes would call for the slower evaporating qualities. Their use in coating compositions would not necessitate any modification in the normal procedure adopted for normal petroleum fractions, etc. The advantages they offer, reside in their ability to dissolve appreciably more of the common gums and resins and in the far greater quantities that are permissible when they are used as diluents. This is a natural reflection of their high kauri-butanol values. The hydrogenation process described was developed by the Standard Oil Co. of New Jersey in co-operation with the I.G. (Germany) and is an established full scale refinery process in America to-day, not only in the manufacture of high solvency naphthas, but also for high-octane number petrols, safety aircraft fuel, good burning quality kerosenes and hydrogenated lubricating oils.

Points from the Discussion

The PRESIDENT said that in this country most of the products mentioned in the paper were obtained by primary fermentation as starting point, whereas in America they were now being obtained from petroleum. From that point of view it was clear that the text-books on organic chemistry would need very considerable revision. The gum from petroleum, of which the author had shown some samples was an extremely interesting product and it seemed there were considerable possibilities in that direction. On the question of white spirit versus turpentine it had always been understood that turpentine was a better solvent than white spirit for some purposes, but perhaps that point of view was countered to-day by the fact that white spirit is very different from what it used to be, and its solvent power was, according to what the author had said, very considerable.

Dr. R. S. MORRELL asked whether the author was quite certain when he stated that petroleum hydrocarbons play an important part in the production of ethyl ether. He was very glad to hear what the author had said with regard to petrol-

eum resins because he himself had some samples of such resins obtained from cracked petroleum products and although he had not yet started to investigate them he certainly should do so now. In all these matters, however, the question of the relative price of products obtained from petroleum and those obtained from other sources must come into consideration. Hydrogenated solvent naphthas seemed to be substances of importance owing to their peculiar solvent properties but how did they compare in price with, say, benzene and the aromatic hydrocarbons. It was a comfort to know that there was another source from which these substances could be obtained.

Mr. KELLY said that the statement in the paper that ethyl ether was derived almost exclusively from petroleum in the United States was based on private information which he believed to be quite authentic. Petroleum resins were being produced in the States to-day to the extent of about 1,000,000 lb. per annum and they would be seen on the English market eventually. They were being produced at extraordinarily low prices at the present time, approx. 0.25 dollars per lb. Of course, the present state of the dollar was very uncertain but on the basis of par value this represented 1s. 3d. per lb. in America to which, of course, would have to be added freight charges and possibly also import duties into this country. Nevertheless, he believed they would be serious rivals to the natural resins when they arrived in this country.

A White Spirit Enthusiast

Dr. L. A. JORDAN, referring to the question of white spirit *versus* turpentine, said he gathered that Mr. Kelly was a white spirit enthusiast, and to him and other similar enthusiasts he would suggest that, having a good case, they should not over state it. At the same time, it seemed a little hard for the author to say " Nevertheless some paint makers continue to use turpentine partly or wholly as their thinner, the urge in this direction mainly arising out of prejudice or pride in a national industry." Such a statement was totally unnecessary because it must be recognised that the white spirit industry was getting all it could reasonably expect and that turpentine, having a use in particular circumstances, would continue to be used in those circumstances.

Mr. KELLY said he had raised the white spirit *versus* turpentine controversy in the paper in the hope that he would hear something about it from other people. On further consideration, however, he would modify the paragraph to which Dr. Jordan had taken exception.

Mr. J. PARRISH said that as one representing both the paint and the petroleum industry he felt the author had given an excellent resumé of the state of the petroleum industry which at the present time was very much in its infancy. It was a matter of some congratulation to chemists, whether paint chemists, oil chemists, organic research chemists or any other type of chemists, that at last the chemist in the petroleum industry was really beginning to come into his own. Up till now the petroleum industry had been mainly the realm of the geologist and the engineer, but the chemist was now beginning to make his presence felt. What the author had said as to the general developments in the petroleum industry was only a mild statement of what was really happening behind the scenes because naturally Mr. Kelly could not speak of everything that was going on in regard to by-products from petroleum. Great strides were being made and within the next ten years there would be very great developments. As to white spirit and turpentine, it must be agreed that both had their definite limitations. White spirit was used and was being used in increasing quantities, in the production of paints, but he would not say that its use was possible in all direction. Indeed, he did not think it was. On the other hand, there were light spirits on the market which in their present form as a cheap material represented a definite stepping stone from the paraffin hydrocarbons to the purely aromatic hydrocarbons such as benzene or solvent naphtha. There were now spirits which went halfway in that direction which had a very high content of aromatic hydrocarbons and a relatively high solvent power. These white spirits were, of course, also available in the form of what were called special boiling point spirits, largely used for the extraction of both edible and paint oils.

Mr. KELLY, emphasising the point as to the developments now going on in the petroleum industry, said the industry was carrying on intensive research to find an outlet for by-products which were being made in enormous quantities. For instance, there was one oil well in California from which 100,000,000 cu. ft. of natural gas per day was obtained, but at the present time the price which could be obtained for it would not cover transportation charges and therefore the gas was being blown into the atmosphere. In the efforts to find increasing means of revenue for the petroleum industry the chemist would have a great deal to say. He had not emphasised the special boiling point solvents because they were perhaps not of indirect interest to the paint industry but when it was realised that some 200,000 to 250,000 tons of oil seeds and nuts were extracted annually in the United Kingdom by these solvents, it would be seen that there was an important field for them. Moreover, in oil extraction in this way 1.7 gallons of solvent were lost per ton of material treated, and this again indicated the magnitude of the market for such solvents. As a matter of fact, he had tried to obtain some reliable statistics in this connection but the various firms concerned were not anxious to disclose the nature of their work. He understood that linseed oil was being extracted by petroleum solvents in the United States and in Europe and enormous quantities of soya bean and castor oil were also being extracted in that manner in this country.

Developing Natural Hydrocarbons

Mr. J. HEDLEY BARRY said it had to be admitted that the United States during the past few years had made great strides in developing the natural hydrocarbons. The subject seemed to be almost bewildering in extent and it become more so when one realised that other branches were developing equally rapidly. The wood turpentine industry had also produced a new sphere of chemistry which was also becoming bewildering and the chemist in the future would have to decide which of the various solvents were worth trying most. Many in the pigment trade were interested to know something about the mysteries of the properties of different carbon blacks; for instance, one gave a "short" printing ink and another gave a "long" printing ink. This simply exemplified the numerous problems even in one small branch of the industry alone. The new petroleum resins were extremely interesting and one naturally thought of cumarone in that connection because cumarone was a simple polymer and one would expect certain similarities. Having done some work with cumarone himself he had been rather puzzled that it seemed to have certain specific limitations, or it might be that other materials filled the bill equally well. These new resins it seemed to him might come in to solve one of the problems which had been referred to in a recent discussion at a meeting of the Association, namely, a protective coating for things like tankers, where resistance to gasoline was a matter of importance. He believed he was right in saying that so far no absolutely successful method had been obtained for solving that problem.

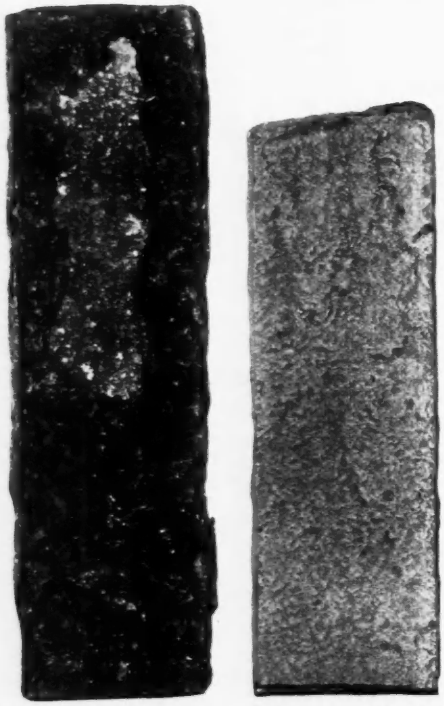
Mr. K. A. WILLIAMS expressed the view that one of the most interesting points of the paper was the description of the application of catalytic methods by the petroleum industry and in particular the description of the production of acetone from iso propyl alcohol. This demonstrated the difference between this country and America. In this country we made iso propyl alcohol from acetone and conditions were such that alcohol from acetone fetched nearly twice the price of acetone. As a price relation between the two products in America it must be quite obvious that if acetone did not fetch more than iso-propyl alcohol it ought to.

Mr. KELLY said the acetone-iso-propyl alcohol situation had interested him. He believed at Hull they made acetone from ethyl alcohol but the point he wished specially to mention was that in one works on the Continent—in Bethune—a mixture of iso-propyl alcohol and ethyl alcohol was made in one process. It was found very difficult to separate the two and they therefore converted the mixture into acetone and converted that into iso-propyl alcohol again. It seemed, therefore, that the question of whether iso propyl alcohol should be converted into acetone or vice versa depended on the market conditions in the particular country. He understood that a considerable amount of acetone was made last year in the United States from iso-propyl alcohol but the whole question was resolved by which process was most profitable.

Preservation of Chemical Works Plant

Lead as a Corrosion-Resisting Material for Iron and Steel

In chemical and allied factories the question of a satisfactory method of preserving the plant, especially iron and steel plant, is one which requires careful consideration in view of the many varied forms of destruction arising from the aggressive attack of corrosive chemicals that create destructive fumes in the atmosphere. Those who have to overcome this problem of corrosion cannot fail to be vitally interested in every method for combating the evil. In view of the allowance granted by the Revenue authorities for depreciation, everyone responsible for the maintenance of works and plant should be continually on the alert for information regarding new and tried methods of renewing existing machinery and preserving newly erected workshops and machinery. Numerous substances and methods of application, suggested from time to time, claim to permanently protect iron and steel from attack by corrosive fumes, but it is well-known that one of the oldest and most efficient mediums is lead. Hitherto, however, the inexpensive application of lead to masses of iron and steel *in situ* has been a baffling problem, but the Nor-Rust Liquid Lead Co., Ltd., have now solved this problem in an extremely interesting and scientific manner. By



Unprotected Steel (left) compared with Nust-treated Steel (right), after exposure to corrosive atmosphere.

the treatment of a selected number of metals among which lead predominates they have succeeded in obtaining a product known by the trade-name of "Nust," which has unique characteristics that do not exist in products similarly applied for preservation purposes.

The "Nust" process of manufacture is such that by the heat treatment of the metals used, an alloy pigment of extreme fineness is obtained, which is suitably blended with oils that are absorbed by the pigment in a manner similar to that by which a sponge absorbs water. This allows the alloy pigment to be applied to any size structure *in situ* by a simple painting process. During the drying and ageing of the applied "Nust" a definite action takes place whereby the alloy pigment precipitates on to its foundation and protects the metal underneath with a homogeneous film of alloyed metals of known corrosive resisting properties. Moreover, the film does not deteriorate but becomes more metallic the longer it is exposed to air, and, in addition, definitely prevents any underneath corrosion effects likely to create a "flaking off" condition.

It is frequently found that creeping corrosion occurs when paints are subject to attack by acid fumes, and this is generally due to the acid penetrating the vehicle oil and setting up corrosion under the pigment film, whereas in the case of "Nust," even when only one coat is applied, two coats, an upper and lower film are formed. The lower film, adjacent to the foundation, contains the highest percentage of alloy pigment, which eventually becomes the main metallic film, whereas the upper film contains a majority of the conveyor oil from which the alloy pigment has been deposited on the foundation; after suitable ageing, the upper film can be removed, revealing the firmly adherent lower metallic alloy film. Under certain conditions, moreover, paint coverings are subject to expansion and contraction due to the variations in temperature and the expansion properties of the metal to which they are applied. A paint film on account of natural influence during ageing, in time loses its elastic qualities and finally cracks and loosens on its foundation: to be effective against corrosion a paint film must therefore be so created as to avoid these detrimental characteristics. In comparative pendulum tests in which paint films have been subject to alternative heating and freezing, the "Nust" alloy paint body showed excellent results and a marked superiority in elasticity and flexibility.

"Nust" has been subjected to attack from very severe fumes by Riley, Harbord and Law, chemists and metallurgists, in their laboratory fume cupboards and has resisted the attack of strongly corrosive moist atmospheres in which large quantities of nitric and hydrochloric acid were present. It has also proved its resistance to industrial fumes, steam, and smoke such as occurs in most factories and gasworks. Its adoption for the protection of iron and steel in chemical factories is developing and under correct conditions of application good results are obtained. The accompanying illustration shows the very rigorous attack on unprotected steel compared with steel which has been "Nust" treated. Both specimens were subjected to identical conditions for five months in the bromine room of a chemical factory. Similar results occur from the effects of exposure in brimstone stoves, as used in hosiery finishing factories. "Nust" has many other useful spheres of application and is suitable for the preservation of wood and concrete. In the case of concrete, it is interesting to note that owing to the alkaline resisting qualities of the alloy pigment and its unique characteristics of precipitation on to the foundation to which it is applied, it forms a lower lead base alloy covering which insulates the upper covering containing the conveyor medium from the saponification effects of any seeping alkaline moisture that may arise from the concrete, and *vice versa*, protects the concrete from external sources of attack.

Indian Chemical Industry

A Promising Outlook

Presiding at the annual general meeting of the Institution of Chemists (India), Dr. E. Spencer observed that chemical industries in India had not developed commensurate with the country's resources, the principal reasons being the interdependence of the different branches of modern heavy chemical industry. In many cases the waste material or by-product of one branch of the industry provided the raw material for another, and owing to this factor, allied branches of the industry had tended to become grouped together. Such groupings, Dr. Spencer said, made it difficult for small undertakings to gain a footing even in India, but for the same reason, once a start was made, further progress should become less difficult. The industries most likely to make a successful beginning were those that were self-contained in the sense that they did not produce useless by-products. A review of the post-war developments of chemical and allied industries in India showed a remarkable progress in some of them, especially the cement and sugar industries.

Joseph Priestley—the Father of Modern Chemistry

By RONALD A. MARTINEAU DIXON, of Thearne, F.R.S, (Edin.)

JOSEPH PRIESTLEY (born 1733, died 1804), whose bicentenary is being celebrated this month, was, in the writer's opinion, one of the greatest Englishmen of history because of the extraordinary and unique combination of abilities and capacity to use them concentrated in one man. He was a theologian and divine who stirred the world, a social and political reformer, and educational expert, a successful practical private school proprietor and teacher, a prolific author of books on theological, social and scientific subjects and a writer on English grammar. He was also a lecturer and a journalist and, in the words of Cuvier, he was " The Father of Modern Chemistry." Further, he was the discoverer and investigator, within a few years, of nine new gases—giving them their modern names—hydrochloric acid [hydrogen chloride], sulphur dioxide, nitrogen, nitric oxide, nitrous oxide, ammonia, oxygen, silicon fluoride and sulphuretted hydrogen.

Sir T. E. Thorpe wrote of Priestley: " It is obvious that he obtained chlorine without recognising it, even before the news of Scheele's discovery reached this country. He had also prepared, without knowing it, phosphoretted hydrogen and phosphorous acid. Modern eudiometry, making use of methods of far greater precision than were possible to Priestley, has confirmed his supposition that atmospheric air is remarkably constant in composition and that its wholesomeness depends upon other causes than the relative amount of the dephogisticated air contained in it." Priestley was a delightful letter writer, a strict attender to his duties as a pastor, a constant teacher of the children and young people of his congregation, and a devoted friend and companion of his wife and family. He was a minister of religion at Needham Market, Nantwich, Leeds, Birmingham and Hackney, a special preacher by request before members of the United States Congress, and was offered the post of Professor of Chemistry in the University of Pennsylvania and the office of Principal of that University. He was also invited to become minister of the New York Unitarian Church.

Priestley's Discoveries

He was an investigator and discoverer in electric conductivity and the discoverer of the oscillatory character of the lateral explosion, to use his own term, in the science of electricity. He discovered the principle of soda water, for which amusingly the Royal Society is said to have awarded him the Copley Medal, their highest honour. He also discovered, after numerous experiments, the fact, as recorded by Sir Oliver Lodge in his " Joseph Priestley " article incorporated in " Nine Famous Birmingham Men," that " the air which was spoilt by animal life was renewed by plant life—that the two acted in opposite directions and so kept the atmosphere of constant quality."

In 1776 Priestley's memoir on respiration and on the use of blood was published, and in Sir Philip Hartog's opinion it was this memoir which originated Lavoisier's great researches published alone and with others on animal respiration and animal heat. Another discovery by Priestley on the "Melioration of Air by the Growth of Plants " is regarded by Sir T. E. Thorpe as of fundamental importance, and he holds that Priestley clearly proves that this "melioration" is "connected with the green matter of leaves and that it is dependent upon sunlight." Another discovery is attributed by Sir Philip Hartog to Priestley's work on diffusion. He states that "Dalton's atomic theory was derived from the consideration of mixed gases, in connection with a proposition from Newton's " Principia " and the work of Priestley on diffusion."

It is true that Boswell called Priestley a " literary Jack-of-all-trades," but that was in accord with the Boswell nature, not in accord with the giant he snarled at. He was the honoured friend of the most distinguished people of his time, yet the Birmingham mob burnt him out of home and house and attempted to stone and murder him. " He was several times burnt in effigy along with Tom Paine. Coloured caricatures of him, of the grossest and coarsest kind, in which he was described as ' the treacherous rebel and Birmingham rioter ' were scattered broadcast. Insulting letters, in some of which he was likened to Guy Fawkes or the devil himself, were sent to him from all parts of the country, even by men calling themselves ministers of the gospel. In one of these he was threatened with being burned alive before a slow fire . . . . . Burke, to his everlasting shame, inveighed against him in the House of Commons, and many of his associates in the Royal Society shunned him. His position in the Society became eventually so irksome that he withdrew from it." So write Thorpe and Lodge. As Professor Huxley in the first of his essays on " Science and Education," says with reference to this time of Priestley's life, " He not only cheerfuly suffered obloquy from the bigoted and the unthinking, and came within sight of martyrdom," but finding his life in England was intolerable, in the interest of his family he set sail for America with his wife and joined his children there, they having already gone before. He never came back and his grave lies in that far away land. According to Lodge, " his friend and scientific opponent, Lavoisier, had met with even worse treatment at the hands of his ungrateful country. Sentence had been pronounced upon him, with the infamous ejaculation ' The Republic has no need of Chemists,' and Lavoisier was executed by the guillotine."

His Last Hours

Sir Oliver Lodge concludes his " Joseph Priestley," with the ever interesting tale of the death of Priestley: " On February 4, 1804, he finally took to his bed: though he was still able to read proof sheets and check Greek and Hebrew quotations. In the evening he had his grandchildren brought to his bedside, saying that it gave him great pleasure to see the little things kneel. He lingered through the night, and in the early morning requested his son to take down some additions and alterations he wished inserted in his proofs, dictating as clearly and distinctly as he had ever done in his life. When these were read to him he said, ' That is right, I have now done.' Shortly afterwards he put his hand over his face and breathed his last, so easily that those who were sitting close to him hardly perceived that he had passed away."

It is remarkable how all writers and speakers now pay tribute to the greatness of Priestley, now write and talk of Priestley as if they really did love him and find his character and greatness wholly lovable.

We claim for Priestley his position as one of the three greatest of Englishmen, the other two being Shakespeare and Milton. Nay we claim him, taking him all round and considering all things, as the greatest of all Englishmen.

Cotton Mercerisation

Light Creosote as a Wetting Agent

THE discovery that considerable savings in respect of plant, time and consumption of alkali can be effected in the process of cotton mercerisation by omitting the preliminary boiling with water and immersing cotton directly in an alkali bath in the presence of certain wetting agents, has led to the introduction of a whole series of substances which speed up the rate at which the cotton fibres are impregnated by the alkali. Among the latter are a very large number of special preparations including mixtures of cresol and cyclohexanol, sulphonated higher alcohols and sulphonated glycol ethers.

The interesting announcement is now made that even more rapid wetting can be effected with the aid of light wood creosote, the by-product of the manufacture of pure creosote for pharmaceutical purposes in the course of wood tar distillation. According to Dr. W. Pohl, writing in the "Chemiker-Zeitung," February 22, 1933 (p. 142), the speed of wetting of dry cotton with 20 per cent. sodium hydroxide solution employed in mercerisation is increased to an extraordinary extent by the addition of 1.5 gram of light creosote to each litre of the bath. Light creosote thus appears to be superior to many of the commercial preparations which require to be added to the mercerisation bath in ten times the above quantity.

Problems in Industry

Short Talks to the Nottingham Section of the S.C.I.

A SERIES of short talks on problems in industry were given at a meeting of the Nottingham section of the Society of Chemical Industry, held on February 16.

Mr. S. SPRAY described some experiments he had made on the relative corrosion in dilute sulphuric acid of samples of cast iron, in which the graphitic carbon was present in coarse and fine form respectively. Each specimen was immersed in the dilute acid together with a carbon rod to which it was connected externally by means of a copper wire. This connection was broken at intervals and electric measuring instruments put in the circuit. The loss in weight of each sample was also determined. He expected that a higher external current would go with a greater loss in weight, but the opposite was found to be the case. Specimens with coarse graphite gave lower readings and greater loss in weight than those with fine graphite. He had argued that the finer graphite should provide the larger surface area to react with iron, and leave less iron to act with the carbon rod, and that therefore the external current should be lower than in the case of coarse graphite, whereas in fact, fine graphite gave the higher readings. He would, however, be interested to hear an explanation of these facts.

Test for Presence of Bitumen in Tar

Mr. G. P. STORER mentioned a test, described as being for the presence of bitumen in tar. This was the only one he had been able to find and consisted in the addition of dimethyl sulphate to the fractions distilling between 270 and 350° C. After half an hour the separated oil is read off. The test was tried and gave a negative result with ordinary prepared tar, and a positive result after 10 per cent. of bitumen had been added to the tar. The test therefore made a routine one on deliveries of the tar mixture, and appeared to be reasonably satisfactory until an occasion when a negative result was obtained although the suppliers were positive that the proper amount of bitumen had been added. Further tests were then made, and it was found that the addition of bitumen made no difference to the result, which was a function simply of the original tar; it was found that tars from vertical retorts, which often contain paraffins, gave a result in the test, while nothing was obtained with tars from horizontal retorts, which do not usually contain paraffins. The conclusion was therefore reached that the test simply showed paraffin products and not bitumen at all. He would be very interested to hear of a satisfactory test for bitumen.

Damage to Artificial Silk Goods

Mr. T. F. HEYES mentioned a fault in artificial silk plated socks which on the face of it, would be attributed to the dyer of the goods, and which could only be elucidated by chemical means. It was found that a number of artificial silk socks with a backing of cotton were coming up after dyeing, with the face of the fabric damaged, showing numerous broken ends of artificial silk, and even the backing exposed in places. The obvious explanation was that the fabric had been damaged in the scouring or bleaching, so further lots were dyed without bleaching, and in a soap lather without previous scouring; the socks were also turned inside out, so that the backing would give protection from mechanical damage, but it was found that the fault still occurred. Fortunately, some similar goods were available, which had not been treated in any way. Oil, etc., was removed by petrol ether, and a sock was unravelled. Using parts of the yarn which appeared quite sound, the physical characters were determined, and all were fairly normal, including the breaking load and per cent. breaking load lost on wetting so that by themselves they would not throw any suspicion on the quality of the yarn. The copper number and fluidity of 2 per cent. solution were next determined, giving 2.4 per cent. and 6 units respectively. These figures showed that the yarn was quite badly degraded. The yarn was a viscose silk, which had been dulled in process of manufacture, probably by the inclusion, in the spinning solution, of a liquid insoluble in viscose. The fault must have originated in the manufacture of the yarn, and was possibly connected with the production of the dulled finish.

Mr. G. E. L. CARTER gave an account of some of the troubles of the tanner and finisher of leather due to the natural variations between parcels of skins, skins in the same parcel and between different parts of the same skin. As uniformity of the finished product is desirable, the manufacture of leather includes processes designed to minimise, as far as possible, these variations. Area, shape and thickness are taken into account in the processes, largely by frequent grading.

Imperfections in Skins

Imperfections of the skins such as scabs, abrasions, growth marks, etc., can only be detected early, if they are very bad, but if only slight, they may not be detected until the finishing stages. The texture of the skin is greatly affected by the quality of the food supply, and also upon the health of the individual animal. Any disorder of the system results in a diminution of the nourishment supplied to the skin with a corresponding fall in quality. The texture varies in different parts, and may in some measure be controlled. A section from the butt of a good chrome calf skin suggests, in pattern, a tightly woven material. The bundles of fibres are woven in a fairly even pattern, often appearing at an angle of about 40° to the horizontal when running parallel to the plane of the section. The cross sections of the bundles may approximate to circles, and there are few open spaces. A section from the belly, on the other hand, shows fibre bundles, in the plane of the section, nearly horizontal, and the form of their cross section never approaches a circle. The structure is full of open spaces, and the general effect is that of a loosely woven mat.

The loosening of the hair and modification of the skin structure may be effected by the same reagent, a mixture of lime and sodium sulphide, when the hair may be scraped off by a blunt knife, leaving behind the pulped fat glands and other tissue, which is removed by squeezing. The duration of the liming is very important, as different parts of the skin are not attacked at the same rate, and some skins are ready before others. If the skin is withdrawn too soon, dehairing is difficult The structural character of the skin, as it leaves the limes, is preserved throughout the remaining processes, supposing the latter to be properly carried out. Any attempt, therefore, to influence the nature of the skin in the direction of uniformity of texture, must aim at a more complete control of structure modification during the unhairing processes.

Canadian Metal Mining Industry

Competition and Low Production Costs

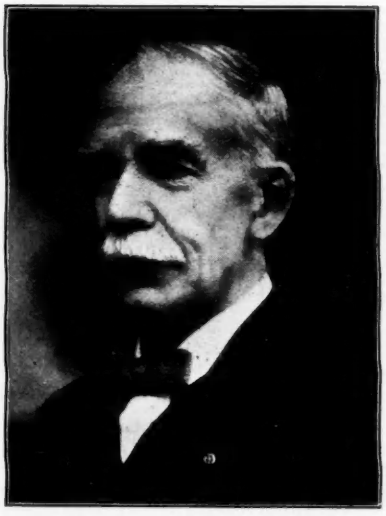
IN his presidential address to the convention of the Engineering Institute of Canada held recently at Ottawa, Dr. Charles Camsell, Deputy-Minister of Mines in Canada, stated that Canada's metal mining industries are for the most part excellently equipped with ample supplies of raw materials and have production costs among the lowest in the world. While Canadian metal mining industries may have to face more intensive competition than has hitherto been the case, they are well able to take care of themselves in world metal markets. The mineral strength of the British Empire has come into view only very recently, but collectively it now surpasses that of any nation. Canada's advances in mining and metallurgical enterprises have added enormously to that strength. Ten years ago, the Dominion produced barely 100,000 tons of copper, lead and zinc, but by 1930 the annual output of these important industrial metals had increased to 400,000 tons. The chief market for Canadian metals has been in the United States, which in that year took about 66 per cent. of the total, as against 10 per cent. by Great Britain. In the following year, although the exports of Canadian non-ferrous metals in common with other commodities fell greatly, the percentage to Great Britain increased to nearly 18 per cent., while there was a decrease in the proportion of non-ferrous metals going to the United States to about 61 per cent.

President-Elect of the Society of Chemical Industry

Congratulations to Dr. J. T. Dunn

THE annual chemical and allied industries North East Coast dinner at the Royal Station Hotel, Newcastle, on March 10, was the occasion of the first public announcement of the nomination of Dr. J. T. Dunn, public analyst for Newcastle and Sunderland, to succeed Dr. R. H. Pickard as president of the Society of Chemical Industry. In the normal course of events Dr. Dunn will be elected at the annual meeting of the Society at Newcastle about the middle of July. Dr. Dunn has already held the position of chairman of the Newcastle section of the society, in which he was succeeded in 1932 by Professor G. R. Clemo. For over 30 years Dr. Dunn has served as public analyst to the Newcastle Corporation, and for many years he has acted in the same capacity for a number of boroughs in the North-East. In 1930 he was elected president of the Society of Public Analysts—one of the highest honours that can be attained in the profession. He has been a member of Newcastle Literary and Philosophical Society since 1871, and is a past-president of Newcastle Rotary Club. The stage is his hobby, and he is a past-president of Sunderland Drama Club.

The annual dinner was as usual arranged by a joint committee representing the Chemical Society, the North of England Gas Managers' Association, the Newcastle Chemical Industry Club, the Northern Section of the Coke Oven Managers' Association, the North-East Section of the Institute of Chemistry, the Newcastle Section of the Society of Chemical Industry and the North-East Section of the Institute of Metals. The dinner, which was presided over by Dr. J. T. Dunn, was a great success, and one of the features was the reading of the following telegram from Dr. Pickard, president of the Society of Chemical Industry: "Congratulate section of Newcastle upon election of Dr. J. T. Dunn as next president of the Society of Chemical Industry." This was received with great enthusiasm by the representatives of the societies present.



Dr. J. T. Dunn, President-Elect of the Society of Chemical Industry

Professor G. R. CLEMO proposed "The Profession of Chemistry," and coupled with it the name of Mr. H. T. Tizard, Rector of the Imperial College, London. Referring to the number of separate chemical organisations, he said that amalgamation had become an urgent question and this year was likely to see some development in that direction. The problem was a difficult one and the mistake should not be made of thinking that London was the chemical world.

Mr. H. T. TIZARD, responding, said that though London was such a big centre of learning it was so big that it had not quite the civic spirit of some cities in the provinces. Newcastle, however, was just the size for a town in which a great university should flourish.

Mr. S. G. HOMFRAY proposed "Chemistry and Industry," to which Dr. A. E. Dunstan, chief chemist of the Anglo-Persian Oil Co., replied.

Professor H. L. RILEY, proposing the chairman (Dr. Dunn), said that no better man could have been chosen for the honour which had fallen to him.

Dr. DUNN, responding, was received with musical honours.

Imperial Chemical Industries

Ordinary Dividend Restored to 1930 Level

THE directors of Imperial Chemical Industries, Ltd., announce that the gross income for the year 1932 amounts to £6,415,423, as compared with £4,668,685 for 1931. After allocating £1,000,000 to central obsolescence and depreciation fund and providing £686,351 for the company's income tax, the net income amounts to £4,729,072, as against £3,408,290 for 1931, or an increase on 1931 of £1,320,782. With the balance brought forward, £516,825, the total balance available is £5,245,807. After providing £1,586,751 for preference dividend and £1,089,740, equivalent to 2½ per cent. interim dividend on the ordinary shares, paid on December 1, 1932, the directors have appropriated £500,000 to general reserve and have decided to recommend a final dividend on the ordinary shares of 3½ per cent. (actual), less income tax at the standard rate in force for 1933/34 (reduced by relief in respect of Dominion income tax at the rate of 2½d. in the £), making 6 per cent. for the year, and absorbing £1,525,636. This leaves a balance of £543,770 to be carried forward. The following table shows how the 1932 results compare with the two preceding years:—

	1932	1931	1930
	£	£	£
Gross income	6,415,423	4,668,685	5,129,757
Brought in	516,825	653,483	349,926
Available	6,932,248	5,322,168	5,479,683
Income tax	686,351	260,395	156,365
Central obsolescence fund	1,000,000	1,000,000	500,000
Pref. dividend	1,586,751	1,583,416	1,554,554
Ord. dividend amt. ...	2,615,376	1,961,552	2,615,281
Ord. dividend rate % ...	6	4½	6
General reserve	500,000	—	—
Forward	543,770	516,825	653,483

The annual meeting will be held at 11.30 a.m. on April 11.

Pay Cuts Restored

Simultaneously with the issue of the company's preliminary statement on Wednesday a notice announcing the restoration of wage cuts effected two years ago, signed by Sir Harry McGowan, chairman of the company, was posted in all I.C.I. chemical and explosive factories. The number of workers affected is 25,000, and the notice is in the following terms: "In May, 1931, the Chemical Trade Joint Industrial Council authorised reductions of wages on the representations of the Chemical and Allied Employers' Federation regarding the economic situation of the industry. The workers throughout I.C.I. loyally accepted those reductions. I am happy to announce on behalf of the board of Imperial Chemical Industries, Ltd., that the company is now able to increase the rates of the adult male workers concerned by an amount equivalent to the reduction which was authorised by the Joint Industrial Council, *i.e.*, five-eighths of one penny per hour. In the case of boys and youths under 21, and of female workers, whose rates were reduced by the resolution of the Joint Industrial Council, the increase in the rates will be five-sixteenths of one penny per hour. In the case of piece workers, the reduction of 5 per cent. authorised by the Joint Industrial Council will cease to operate. These alterations will take effect from April 3."

British Overseas Chemical Trade in February

A Slight Increase in Exports

EXPORTS of chemicals, drugs, dyes, and colours during February amounted to a total of £1,322,501, being £15,649 higher than the figure for February, 1932. Imports totalling £640,950 were lower by £895,628, and re-exports totalling £33,597 were lower by £96,901, as compared with February, 1932.

	Quantities. Month ended February 28. 1932.	1933.	Value. Month ended February 28. 1932. £	1933. £
Imports.				
Acetic Anhydride cwt.	441	370	1,299	977
Acid, Acetic .. ,,	1,492	11,566	66,660	18,766
Acid, Tartaric, including Tartrates .. cwt.	140	180	599	616
Bleaching Materials ,,	12,600	7,745	22,738	4,971
Borax .. .. ,,	33,190	7,700	17,245	4,240
Calcium Carbide .. ,,	197,645	42,481	124,089	24,641
Coal Tar Products, not elsewhere specified value	—	—	3,860	226
Glycerine, Crude .. cwt.	1,606	9,255	2,077	11,283
Glycerine, Distilled ,,	116	316	277	583
Red Lead and Orange Lead cwt.	7,773	1,441	10,757	1,434
Phosphorus .. ,,	27	1	225	11
Kainite, etc. .. ,,	165,418	78,297	33,120	13,627
Potassium Nitrate (Saltpetre) .. .. cwt.	13,113	5,093	13,326	4,594
Other Potassium Compounds .. .. cwt.	118,566	44,687	99,498	33,870
Sodium Nitrate .. ,,	44,180	120	16,297	87
Other Sodium Compounds cwt.	46,498	26,108	42,227	15,996
Tartar, Cream of .. ,,	360	520	1,365	1,729
Zinc Oxide .. tons	389	21	8,700	334
Other Chemical Manufactures .. .. value	—	—	344,739	158,110
Quinine and Quinine Salts oz.	385,934	135,393	41,088	13,346
Bark Cinchona (Bark Peruvian, etc.) .. cwt.	2,362	213	14,442	918
Other Drugs .. value	—	—	172,964	95,045
Intermediate Coal Tar Products used in manufacture of Dyes.. cwt.	33	21	444	384
Alizarine and Alizarine Red .. .. cwt.	—	—	—	—
Indigo, Synthetic ,,	—	—	—	—
Other Dyestuffs .. ,,	7,162	3,333	174,608	75,807
Cutch .. .. ,,	1,483	228	2,453	260
Other Extracts for Dyeing cwt.	7,238	1,714	23,893	5,294
Indigo, Natural .. ,,	11	6	211	90
Extracts for Tanning (Solid or Liquid) cwt.	143,068	95,847	117,360	64,839
Barytes, Ground .. ,,	63,179	25,092	13,965	4,844
White Lead (Dry) ,,	19,899	5,158	29,738	6,143
Other painters' colours and materials .. cwt.	75,252	62,976	136,314	77,885
TOTAL .. value	—	—	1,536,578	640,950
Exports.				
Acid, Sulphuric .. cwt.	4,998	6,238	2,866	3,352
Acid, Tartaric, including Tartrates .. cwt.	690	620	3,930	2,720
Ammonium Chlorate (Muriate) .. .. tons	408	385	6,137	6,696
Ammonium Sulphate ,,	24,092	26,571	125,948	148,552
Bleaching Powder (Chloride of Lime) .. cwt.	24,280	36,911	7,796	10,362
COAL TAR PRODUCTS—				
Anthracene .. cwt.	22	149	35	63
Benzol and Toluol gal.	125,290	11,793	11,080	1,242
Carbolic Acid (Crude) ..	952	8,932	143	1,076
Carbolic Acid (Crystals) cwt.	621	237	1,690	894
Cresylic Acid .. gal.	53,857	70,815	5,387	6,405
Naphtha .. ,,	2,098	14,078	235	873
Naphthalene (excluding Naphthalene Oil) cwt.	5,200	15,603	1,659	4,786
Tar Oil, Creosote Oil, etc. .. .. gal.	214,339	1,605,166	4,815	24,678
Other Sorts .. cwt.	6,640	7,180	6,593	6,134
Coal Tar Products (Total)	—	—	31,637	46,151
Copper, Sulphate of tons	4,870	3,183	84,956	48,879
Disinfectants, Insecticides, etc. .. .. cwt.	27,082	25,805	68,224	58,426
Glycerine, Crude .. ,,	3,773	545	5,807	851
Glycerine, Distilled ,,	19,224	10,595	33,430	21,616
Potassium Chromate and Bichromate .. cwt.	1,853	1,565	4,890	3,754
Potassium Nitrate (Saltpetre) .. .. cwt.	1,194	1,456	1,944	2,116
Other Potassium Compounds .. .. cwt.	2,136	5,426	6,704	8,224
Sodium Carbonate, including Crystals, Ash and Bicarbonate .. cwt.	235,208	302,387	65,235	85,694
Caustic Soda .. ,,	124,789	155,328	86,304	110,386
Sodium Chromate and Bichromate .. cwt.	2,088	1,883	4,557	3,582
Sodium Sulphate, including Salt Cake .. cwt.	29,491	17,934	3,342	2,265
Other Sodium Compounds cwt.	58,555	60,723	64,673	72,670
Zinc Oxide .. tons	1,026	770	20,917	15,088
Other Chemical Manufactures .. .. value	—	—	210,926	212,015
Quinine and Quinine Salts oz.	60,534	49,559	7,951	6,691
Other Drugs .. value	—	—	195,534	177,341
Dyes and Dye-stuffs (Coal Tar) .. .. cwt.	9,627	6,676	82,611	70,858
Other Dye-stuffs .. ,,	7,340	20,421	6,638	16,538
Barytes, Ground .. cwt.	2,911	2,779	1,035	944
White Lead (Dry) ,,	856	1,371	1,621	2,319
Paints and colours in paste form .. .. cwt.	19,180	19,077	34,544	31,732
Paints and Enamels prepared .. .. cwt.	25,291	25,242	74,094	75,615
Other painters' colours and materials .. cwt.	33,482	37,193	62,601	77,064
TOTAL .. value	—	—	1,306,852	1,322,501
Re-Exports.				
Acid, Tartaric, including Tartrates .. cwt.	64	28	460	173
Borax .. .. ,,	303	4	238	3
Coal Tar Products, not elsewhere specified value	—	—	22	9
Potassium Nitrate (Saltpetre) .. .. cwt.	71	352	100	355
Sodium Nitrate .. ,,	1,130	2,573	496	1,051
Tartar, Cream of .. ,,	481	178	2,094	737
Other Chemical Manufactures .. .. value	—	—	12,502	8,350
Quinine and Quinine Salts oz.	8,543	4,950	1,073	755
Bark Cinchona (Bark Peruvian, etc.) .. cwt.	209	168	567	1,930
Other Drugs .. value	—	—	108,123	18,788
Cutch .. .. cwt.	414	94	846	118
Other Extracts for Dyeing cwt.	311	89	1,446	390
Indigo, Natural .. ,,	10	5	267	95
Extracts for Tanning (Solid or Liquid) .. cwt.	1,271	253	1,071	245
Painters' colours and materials .. .. cwt.	473	218	992	462
TOTAL .. value	—	—	130,498	33,597

A NEW way of utilising the reactions which take place in the chamber process of the manufacture of sulphuric acid in Germany, is proposed by the firm of Müller, Forbes and Fort. The inventors, for example, find that the nitro-sulphuric acid formed in the lead chambers is rapidly hydrolised into sulphuric and nitric acids.

The British Association of Chemists

Annual Dinner of the London Section

THE London Section of the British Association of Chemists held its annual dinner and dance at the Palace Hotel, Bloomsbury, on March 11. Mr. H. M. Morgan, chairman of the Section, accompanied by Mrs. Morgan, received the members and their guests, and he presided at the dinner. The president of the Association, Professor E. C. C. Baly, was also present.

The CHAIRMAN, in a brief speech of welcome, mentioned that a measure which would give the Association something it had been striving for for many years had recently been read a second time in the House of Lords. It would give the qualified chemist the right to call himself "chemist" without the necessity for adjectives.

Dr. E. F. ARMSTRONG, who proposed a toast to the Association and the London Section, spoke of the importance of the technical and scientific associations coming together, and said that nothing could be better than that they should come together; but at the same time, he emphasised the importance of preserving individualism, which, as history showed, had been the keynote of the country's success. This reference to individualism, however, was not a criticism of the policy of coming together. The Association was doing great work in the interests of those engaged in chemistry; it was progressing from good to better and from better to best, and there was plenty of room for its continued development.

[*Photo by Non-flash Banquet Photo Co.*

Annual Dinner of the London Section of the British Association of Chemists

A Job of Work Well Done

Mr. C. S. GARLAND, past-president, responding, said that the Association had a real work to perform in the world. It was truly an association of chemists working for chemists, and that distinguished it from all the other chemical bodies in this country. It had a definite job of work to do, and it did not go outside its own particular sphere; it did not wish to do the work of the Institute, or of the Society of Chemical Industry or the Chemical Society, and could not if it wished to. It had a definite task in looking after the material interests of chemists, and it did that well. The London Section was a devoted band of people who served unostentatiously the interests of chemists to the best of their ability. He mentioned specially the president, who had done some wonderful work, and said the Association would see to it that he continued that good work; other great workers were Mr. Morgan, chairman of the Section; Mr. Price; Miss Wright, hon. secretary of the London Section; Mr. Woodcock, hon. treasurer; and Mr. Woodley, general secretary of the Association. The Association, he added, collected only just enough money to enable it to do its work; it did not aim at the accumulation of a great fund, or the maintenance of a great hoard of officials. It was a young and lusty body, and was carrying on from success to success.

Professor E. C. C. BALY also proclaimed his faith in the great future of the Association. It had a future even greater than many had conceived, and he believed that 30 or 40 years hence it would be the big controlling factor in the good fortune of chemists. It was worth while, therefore, that all connected with it should throw their whole energy and skill into its work, and do all they could for the good comradeship and "freemasonry" of the profession.

The health of the guests was proposed by Mr. S. R. Price, and Dr. H. Levinstein responded.

Following a brief musical programme, for which thanks are due to Mr. H. E. J. Cory, the members and their guests spent an enjoyable evening dancing.

Ideal Home Exhibition

Rooms of the Scientists

GLIMPSES of the surroundings in which worked men whose names are illustrious to-day will be revealed in a new feature, "Rooms of the Scientists" at the "Daily Mail" Ideal Home Exhibition, which opens at Olympia on March 29. These fascinating exhibits will include Isaac Newton's tighly shuttered room in the Great Court of Trinity College, Cambridge; Michael Faraday's simple laboratory in Albemarle Street; and the transmitting cabin of Marconi's famous yacht "Elettra." Visitors will see the home of Archimedes of Syracuse, the greatest Greek name in physics; the monkish cell of Roger Bacon; Charles Darwin's study at Down; and the homes of Lister, the pioneer of antiseptic surgery, and Piccard, the famous aeronaut.

A great "Rainbow City" will be the motif of the exhibition. Among special features will be a country village with ten furnished modern houses and bungalows; a home cinema section; a series of commonsense kitchens; a pageant of fashion; and a skyscraper flat such as progress may bring us to in 1950.

Works Equipment News

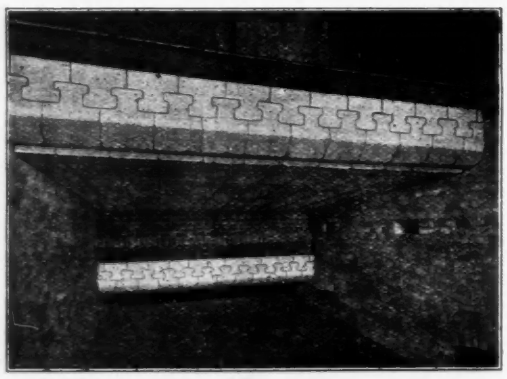
Modern Aids for the Chemical and Allied Trades

In practically all works where the measurement of quantities of liquids is necessary, an accurate and reliable automatic liquid weighing machine is essential. The "Steinmüller" automatic liquid weight measuring machines, represented in England by The Premier Filterpress Co., Ltd., fulfil this requirement in all respects. Quantities, temperatures, gravities, etc., do not affect them in any way and the machines are supplied under a guarantee that the results recorded will be within ± 0.1 per cent.; they are accepted by the State-Institute of Weights and Measures at Berlin-Charlottenburg as being reliable for this exactitude. These machines weigh automatically and continuously and have capacities varying between one and 70 tons per hour. They consist of two balanced vessels which are filled alternately from a common inlet. These vessels are mounted non-centrally on hardened steel bearings and controlled by counter weights fixed to the back. When the exact quantity of liquid has entered one vessel, it tilts and discharges its contents through a pipe, at the same time tilting the inlet towards the other vessel which repeats the operation. As soon as the exact weight has been reached, the vessel tilts forward and commences to discharge and at the same time transfers the inlet to the other vessel. In order to ensure a smooth action of the double tipping vessels, they are provided with double action oil brakes at the back, so that the tipping over and back is accomplished without the slightest suggestion of a jerk. After the vessel has tipped over to start emptying, and after only a small quantity has flowed out, the action of the counterweight brings the vessel back into its original position, the rest of the emptying takes place through a normal efflux pipe working as a syphon.

These weighing machines can be supplied totally enclosed for dealing with hot or volatile liquids and are also built to withstand the action of acids. Owing to the discharge from the weighing machine being through syphon pipes elaborate foundations are not required and the liquid may be taken off from the largest machines through comparatively small ducts in the floor.

Modern Furnace Arches

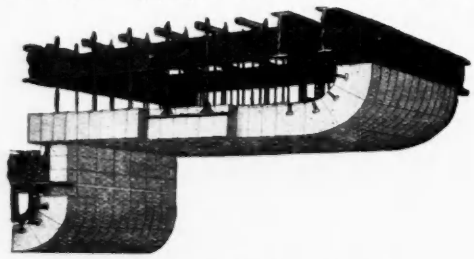
The rapid progress being made with the suspended arch is of great interest to the chemical as well as the metallurgical and ceramic, industries. The "Liptak" double suspension arch and the "Bigelow" single suspended arch and suspended combustion chamber wall, are designed by Liptak Furnace Arches, Ltd. "Bigelow" arches will be found over annealing furnaces in some of the larger steelworks in the Sheffield district where they have been operating for several



"Liptak" Patent Double-Suspension Arch.

years past with entirely satisfactory results. Both constructions have been adopted for a large number of important installations abroad, such as the suspended walls and arches at the new oil refineries at Port Jerome in France; combustion chamber walls and arches for oil-fired boilers in Trinidad; and similar settings for the pulverised fuel fired boilers of the Indian Copper Corporation. Another recent shipment comprised eight "Liptak" double arches, each 9 ft. by 18 ft. wide, for boilers at Montevideo. In general these arches are constructed of a series of strong and heavy steel beams fixed across the roof of the combustion chamber, having attached underneath a series of cast iron brackets carrying cast iron hanger beams.

Double-suspension is one of the most valuable features of the "Liptak" arch, differing from any other methods of furnace construction. Smaller standard firebrick blocks of high grade quality are suspended from the hangers, made of the correct shape, with recesses to engage with the latter forming a reserve arch. To these smaller firebrick blocks are now attached larger firebrick blocks of the same type, formed with a suitable recess or neck at the top to engage with a corresponding projection at the bottom of the smaller

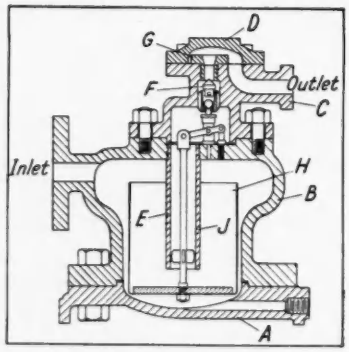


"Bigelow" Patent Single-Suspension Arch.

reserve blocks. In this manner a flat roof is formed of two separate layer of blocks, one above the other, which enormously increases the margin of safety, since if by any chance one of the lower blocks burn out there is no harm done, as the second upper block comes into operation. Moreover each of the larger or main blocks is made with waved or corrugated sides so that pieces do not easily fall out if a block becomes broken. One of the main advantages of the suspended arch is, of course, that almost any width can be constructed, depending merely on the strength of the steel beams; for example, "Liptak" arches 30 ft. wide and over are operating. Each block is entirely independent of its neighbours, being attached to the steel beams above, and therefore not subjected to any lateral strain, whilst allowing of quick and easy replacement.

An Efficient Steam Trap

In chemical works, and industrial establishments generally, hot condensed water from the steam pipe circuits should be collected and returned to the boilers, or used for other purposes. It is important, however, not to use cheap and shoddy



The Economic Steam Trap—A, Base of body fitted with drain plug; B, Body cover; D, Top cover; E, Float tube; F, Valve; G, Valve seat; H, Hollow float; J, Float rod

steam traps for this purpose, with consequent loss of valuable live steam. The "Economic" steam trap, manufactured by Steam Plant Accessories, Ltd., is of the high-duty bucket type, with valve control on the condensed water outlet, elimination of entrapped air, easy accessibility, and positive open-

ing and closing. Essentially the trap consists of a cast iron or cast steel body (according to pressure) bolted to a baseplate, with a bolted cover having a flanged outlet at the top for the discharge of the condensed water. Inside is a large bucket having attached to the bottom, at the centre, a vertical rod working in a bearing. This rod is connected at the top to a lever mechanism in a separate small valve chamber which actuates a nickel-alloy valve, fixed vertically inside the top of the chamber, controlling the outlet. Suspended in the centre of the bucket, but never touching the bottom, is a vertical wide diameter stationary outlet pipe, through the centre of which the valve rod operates, connecting to the valve chamber. The condensed water first nearly fills the body of the trap and then flows over into the bucket. When this in turn is filled it sinks, because of the weight, and the attached rod and lever gear opens the outlet valve. Condensed water is then blown out of the bucket by the steam pressure through the control outlet pipe, discharging to a height of 2 ft. for each 1 lb. per sq. in. pressure, until the bucket is nearly empty, when it becomes buoyant again, and rises to close the outlet valve with a sharp and decisive action. No constant "dribbling" of water takes place, since the valve is always either closed dead-tight or wide open. Entrapped air, one of the problems of efficient steam trap design, is also eliminated, for when the bucket is in the "up" position, with the outlet valve closed, a small port is open to the valve chamber, so that the air bubbles rise to this point, and cannot lodge in the main body. As soon as the bucket sinks to the "down" position and opens the valve, all the air is immediately blown out with the condensed water. Another valuable feature is that the valve is placed at the top of the trap and is therefore easily accessible. The valve and seat are made of hard nickel alloy to resist abrasion. A 1½ in. cast iron trap for pressures up to 200 lb. per sq. in. discharges 800 gallons of water per hour, and the corresponding cast steel trap for pressures over 200 lb. discharges about 600 gallons.

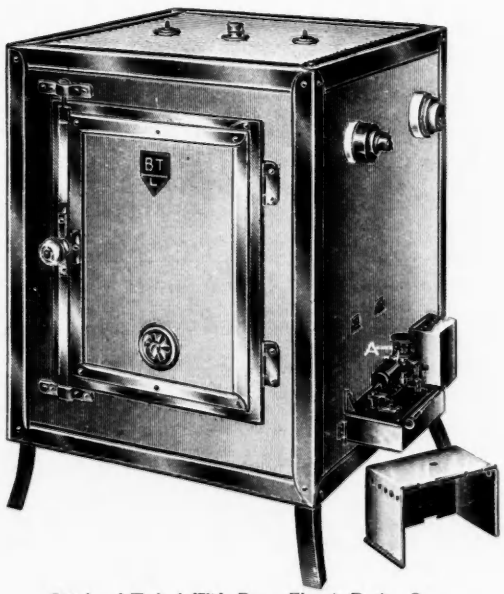
A Wide Range Electric Drying Oven

AFTER many years of experiment, Baird and Tatlock (London), Ltd., have succeeded in producing an ideal drying oven. It has a wide range of temperature—25° to 275° C.; completely reliable automatic temperature control to ± ½°; uniformity of temperature in all parts of the oven, with a maximum variation of 1°; and is absolutely shock proof. The rapid heating switch which is provided enables the oven to ready for use at 150° in 20 minutes, and at the highest temperature in less than an hour after being switched on. The operation of this oven is simplicity itself; it merely consists in setting a switch in one of three positions which are clearly engraved with different ranges of temperatures, and then setting a graduated drum to the temperature required.

The inner chamber is made of 20 s.w.g. medium hard-rolled polished copper fitted with pertorated copper trays. This is surrounded by a 1 in. space forming the heating chamber, in which are fitted the heating elements. The heating chamber is enclosed by walls of asbestos compound, and is insulated with slagwool to a depth of 1 in. all round, and the whole is fitted into an outer casing, consisting of solacite panels in an angle iron frame. The exterior is finished in cellulose enamel. Heating elements are graded so as to obtain an even distribution of heat, and are placed on the sides and back; they are divided into small units so that replacement is facilitated and can be made at very small cost. The wire used is of such generous proportion that it is never subjected to more than half its safe working load, and as an indication of reliability the makers point out that, since these ovens were introduced four years ago, they have not yet had a single inquiry for a spare heating element. Access to the heating space is obtained by removing the screws securing the front and withdrawing the inner chamber, thus exposing all the heating elements. Adequate ventilation of the working space is provided, large adjustable ventilators being fitted on top of the oven near the back and on the lower part of the door.

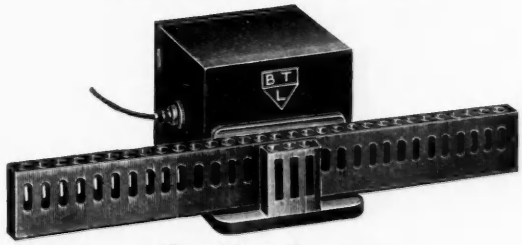
Hydrogen Ion Determination

THE accompanying illustration shows a novel form of comparator for *pH* determinations, consisting of a stationary base and upper metal case of aluminium, holding a revolving wooden drum in which are housed the colour standard tubes. These move before the eyepiece and are illuminated by a lamp fitted into the centre of the drum under the cover shown in the illustration, the three tubes under test being held in a bracket on the outer fixed case. The drum is so constructed as to hold any three specified sets of permanent standard tubes and a number of plain tubes for distilled water—fifty tubes in all—and the apparatus thus covers an extended *pH* range. This comparator is supplied by Baird and Tatlock (London), Ltd., complete with three sets of standard tubes—chlorphenol red, *pH* 5.2 to 6.8; bromthymol blue, *pH* 6.0 to 7.6, and phenol red, *pH* 6.8 to 8.4. Another comparator, devised by Dr. C. H. Spiers, with movable rack for standards and electric lamp fitted in box, as used at the Leathersellers' Technical College, for estimating the *pH* value of tan liquors, etc., is also illustrated.



Baird and Tatlock Wide Range Electric Drying Oven

Circular Comparator for *pH* Determinations



The "Spiers" Comparator

Pumps and Compressors

PUMPS embodying the very latest mechanical and hydraulic features in design, and built to give efficient trouble-free service over a long life of duty, are supplied by Worthing-Simpson, Ltd. The precision construction of all components, and the simplicity of the working parts ensure the utmost reliability in operation with unusually low maintenance and running costs; factors of extreme importance in this class of service. In the range of centrifugal pumps, types "L," "R," and "U" have ball bearings external to the casing of the pump giving adequate support to the shaft; deep stuffing boxes with lantern rings to which an external clean water sealing connection can be made where the liquid handled by the pump demands this; and renewable rings at the impeller hubs, a matter of considerable importance in the maintenance of the pumps dealing with corrosive or abrasive liquids. Furthermore, all these pumps are divided on the horizontal centre line, thus allowing the upper half of the casing to be removed for inspection or cleaning. Where necessary, and within certain limits, they can be manufactured in Regulus metal.

The "Freflo" centrifugal pumps are made in both horizontal and vertical types, and are designed for handling liquids containing a large percentage of solid material, stringy matter, etc., without risk of clogging. Here again, in this type of unit the shaft is supported in ball bearings external to the pump casing. Where the quality of liquid demands it, a lantern ring for external water sealing is provided in the stuffing box. In the case of liquids containing abrasive material a special lining can be provided to resist the action of the matter carried in suspension in the liquid. Complete technical particulars and illustrations of both steam and centrifugal pumps are given in separate bulletins, which can be obtained on application.

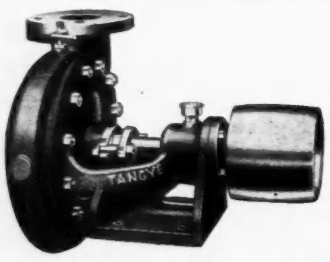
In addition to the extensive range of pumps available for service in chemical works Worthington-Simpson, Ltd., manufacture a group of vertical feather valve air compressors in both air cooled and water cooled types. These units have many uses in the modern chemical works, and the Worthington-Simpson design affords many advantages not found in other small compressors. The special design features of these units include the Worthington patent feather valve—the most scientifically designed valve for compressor service; force feed lubrication—giving positive oiling at all speeds; enclosed construction—ensuring clean oil and long wearing bearings; ground cylinders and all working parts made to precision limits. The company has produced a special descriptive Bulletin WS-1220, which fully describes this range of compressors.

A New Centrifugal Pump

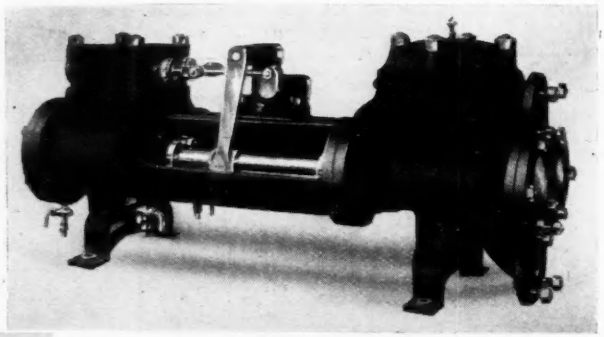
THE new AR type "Tan-Gyro" centrifugal pump, which is illustrated, is capable of pumping against heads up to 100 ft. It is constructed for high speeds and has ball bearings, accurately balanced impeller and grease lubrication. Constructed on precision manufacturing lines, absolute interchangeability of parts is ensured, and the design is such that a belt driven pump can be supplied or a direct motor driven pump with very little alteration. The makers, Tangyes, Ltd., draw particular attention to the fact that the design embodies ball bearings which obviously is a necessity for high speed running. They also lay particular stress upon the design of overhung pulley which definitely prevents bending strain being imposed upon the spindle. The efficiency at all duties is said to be remarkably good. These pumps are made with deliveries from 1 in. to 6 in. diameter, with outputs ranging from 10 to 1,200 gallons per minute.

Danish Paint and Varnish Industry

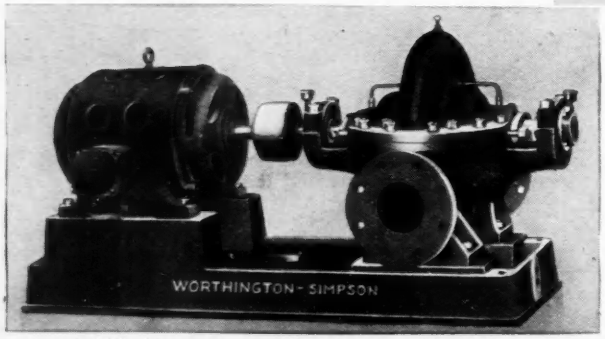
STATISTICS indicate that during 1931 the output of 23 plants producing paint products reached approximately 11,000 tons, 1,000 tons more than 21 plants manufactured the preceding year. The gain is attributed to the fact that the leading purchasers of the industry are the trades which have suffered least from the general depression. The chief items of manufacture are ready-mixed paints, ship paints, varnishes, and lacquers. In addition to the increased consumption of paint products in 1932 there was a smaller export trade in enamels and nitro-cellulose lacquers in Spain, Portugal, Switzerland, the Netherlands, the Baltic States, and Italy. The leading producer in paint products is the Sadolin and Holmblad, Ltd., and during the past year this concern enlarged its plant to include the manufacture of pigments and the establishment of a research laboratory.



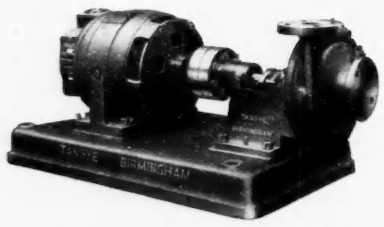
Tangyes AR type Tan-Gyro Pump with Fast Pulley



Worthington-Simpson 6 in. x 4 in. x 6 in. Horizontal Duplex Pump, suitable for Handling Ammoniacal Liquid and for Boiler Feed Service



A typical Worthington-Simpson 10-in. Horizontal Motor-Driven Split-Casing Centrifugal Water Pump



Tangyes Tan-Gyro Pump, Electrically Driven

News from the Allied Industries

Sugar

THE INTERNATIONAL SUGAR CONFERENCE, attended by 30 delegates from those countries adhering to the International Sugar Agreement, opened in Paris on March 14. It is understood there is no question of considering the establishment of a co-operative sales body, as has been erroneously reported in the United States.

Paint and Varnish

PROFITS OF PINCHIN, JOHNSON AND CO., LTD., were £220,997 in 1932, against £272,018 in the previous year. The ordinary shares are to receive a final dividend of 7½ per cent., making 15 per cent., against 17 1-6 per cent., and after transferring £30,000 from general reserve, £47,053 goes forward, against £65,736 brought in. A further capital sterling profit has accrued in the case of foreign investments, and the directors have transferred £18,000 to the special reserve for contingencies, making a total of £43,000. The directors are of opinion that this sum is unlikely to be required, but until the present international situation clarifies, it is considered desirable to maintain this special reserve. Orders in 1932 were a record, and the tonnage sold exceeded that for 1931; prices, however, were lower.

China Clay

THE CHINA CLAY INDUSTRY has suffered a very serious setback in its shipments for February. There has been an unprecedented drop in the china stone for which the St. Austell district has a world monopoly, only 764 tons were despatched last month, compared with 3,022 tons in January, or an average of about 6,000 tons in days of its prosperity. The shipments at Fowey in February were 29,226 tons china clay, 715 tons of china stone, 747 tons of ball clay, a total of 30,688 tons, compared with a total of 38,523 tons in January. Other shipments in February were—Par, 6,443 tons of china clay, 49 tons of china stone; Charlestown, 2,097 tons of china clay, as against 8,445 tons in January; Penzance, 828 tons of china clay; Looe, 243 tons of china clay; Newham, 167 tons of china clay; Plymouth, 136 tons of china clay. The china clay traffic despatched entirely by rail amounted to 5,039 tons, compared with 5,070 tons in January. The aggregate shipments were 44,179 tons of china clay, 764 tons of china stone and 747 tons of ball clay; against 57,644 tons of china clay, 3,022 tons of china stone, and 1,337 tons of ball clay in January, showing an aggregate drop of over 16,273 tons in comparison with January, which is a serious loss to shipping.

Insecticides

SIR R. A. COOPER, chairman of Cooper, McDougall and Robertson, told shareholders at the annual general meeting held on March 10 that the consumption of the company's insecticides, sheep dip and kindred products had been well maintained during the past year. This indicates that the agricultural and pastoral interests at home and abroad, despite the sad plight of such industries, have taken the precaution to be liberal in the use of pest-destroying agencies rather than risk the loss of stocks or crops by false economy. Despite the fact that the bulk of the raw materials used in the production of certain of the company's products had cost more and not less in recent years, he said the board had felt it incumbent to make substantial reductions in the price of many of their lines, with the object of helping their customers through the very severe conditions under which they had laboured, and he was confident that they had enjoyed during the past year an even greater percentage of the available, although severely restricted, trade than had been the case in previous years. In these days of keen competition it was also more than ever essential to keep abreast of scientific research and development, and to that end it was their intention to increase expenditure on technical and research service. Generally, he felt justified in regarding the results of the company's trading, and the soundness of their business, with a certain amount of pride. The profit earned on trading for 1932, after deducting exchange loss, plus profit on investments sold, was £133,384, as compared with £112,846 for 1931, and after deducting the appropriation shown in the profit and loss account, there was a balance available for dividends and reserves of £109,013, as compared with £84,265 for 1931.

Artificial Silk

THE 1932 report and accounts of Canadian Celanese, Ltd., shown that the profit from operations for the year was $1,301,190, compared with $1,200,448 for the previous year. The directors have declared a further dividend of $1.75 per share on the 7 per cent. cumulative participating preferred stock, payable March 31.

Plastics

H.R.H. PRINCE GEORGE will be the guest of honour at the annual trade luncheon of the British Plastic Moulding Trade Association to be held at the Savoy Hotel on March 23. Sir Harry McGowan, chairman of Imperial Chemical Industries, Ltd., Sir Henry Lyons, director of the Science Museum at South Kensington, and Professor G. T. Morgan, director of the Teddington Chemical Laboratory, will also be present. The plastics trade, it is stated, has increased over ten times during the last three years, and during 1932 the value of its products was over £13,000,000.

Cement

PRELIMINARY FIGURES issued by Associated Portland Cement Manufacturers, Ltd., and its subsidiary undertaking, British Portland Cement Manufacturers, Ltd., indicate that operations during the year ended December 31 last have been markedly successful. Despite the slump in the building industry, the parent company appears to have made a slightly larger profit than in the preceding year. In the case of British Portland Cement Manufacturers, Ltd., the comparison is not quite so favourable, but the decline in earnings is quite small. The directors of the latter company have decided to recommend a final dividend of 10 per cent. on the ordinary shares, making 15 per cent. for the sixth consecutive year, and after transferring the usual sum of £255,000 to the depreciation reserve, there remains a balance of £200,522 to be carried forward, against £206,009 brought in. From a dividend point of view the statement of the controlling company is less satisfactory. After paying dividends of 8 per cent. on its ordinary capital for each of the five previous years, the rate is now reduced to 7 per cent. It should be borne in mind, however, that the whole of the issued capital of that class, amounting to £3,500,000, now ranks for dividend, whereas last year a distribution of 4 per cent. only was made on the new issue of 500,000 shares.

Iron and Steel

REPRESENTATIVES OF THE STEEL CARTEL met in Brussels on March 14 and discussed the question of quotas, and penalties for exceeding them. A further meeting will be held at Luxemburg on Monday, March 20. It would appear that an agreement is certain.

SIR WILLIAM LARKE, director of the National Federation of Iron and Steel Manufacturers, is to be the guest of honour of the Royal Empire Society at a luncheon at the Cannon Street Hotel on March 21, when he will speak on the iron and steel industry.

A FURTHER STIMULUS to the iron and steel trade of North Lincolnshire was received this week, when the Frodingham iron and steelworks, in consequence of a substantial batch of orders received from abroad, started up two steel furnaces in their melting shop, a department which had been idle for two and a half years. The steel is required to meet orders for plates for both Europe and America, and in addition to the melting shop, it means further employment in the Appleby rolling mills. Altogether employment will be found for an additional 300 men during the course of this week. The Normanby Park Steelworks at Scunthorpe have also obtained some substantial orders, and this week will be working at almost full capacity.

AT THE END OF FEBRUARY there were 63 furnaces in blast in the United Kingdom, being an increase of one since the beginning of the month. The production of pig-iron in February amounted to 270,800 tons, compared with 286,600 tons in January, and 323,600 tons in February, 1932; the daily rate in February was, therefore, about 5 per cent. higher than in January. The output of steel ingots and castings in February amounted to 482,700 tons, compared with 444,400 tons in January, and 480,600 tons in February, 1932.

Inventions in the Chemical Industry

Specifications Accepted and Applications for Patents

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications Accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Accepted with Dates of Application

PRODUCTION OF VALUABLE PRODUCTS FROM ALIPHATIC OR ALICYCLIC HYDROCARBONS, AND HYDROCARBON MIXTURES CONTAINING AT LEAST ONE TERTIALLY CARBON ATOM.—A. Schaarschmidt. May 31, 1930. 388,734.

LIQUID HYDROCARBON FUELS.—E. I. Du Pont de Nemours and Co., W. S. Calcott and H. W. Walker. June 9, 1931. 388,826.

NORMAL HEPTYL PHENOL AND PROCESS FOR THE PRODUCTION THEREOF. A. L. Mond (McKesson and Robbins, Inc.). July 29, 1931. 388,737.

REFINING AND KINDRED TREATMENT OF HYDROCARBONS. Silica Gel Corporation. Aug. 29, 1930. 388,782.

PROCESSES OF REFINING COPPER.—Electrical Research Products, Inc. Sept. 9, 1930. 388,751.

TREATMENT OF OXIDE COATED ALUMINIUM AND ALUMINIUM ALLOY SURFACES.—Vereinigte Aluminium-Werke Akt.-Ges. Sept. 25, 1930. 388,787.

MANUFACTURE OF SULPHUR DYES.—E. I. Du Pont de Nemours and Co. Sept. 5, 1930. 388,814.

PROCESS OF PRODUCING CHLORINATED DERIVATIVES OF BENZENE.—T. S. Wheeler and Imperial Chemical Industries, Ltd. Sept. 4, 1931. 388,818.

PROCESS FOR BLEACHING VEGETABLE SUBSTANCES.—J. Y. Johnson (I. G. Farbenindustrie). Sept. 10, 1931. 388,832.

MANUFACTURE OF CYCLIC AMMONIUM SALTS CONTAINING AN ACYLATED HYDROXY-HYDROCARBON RESIDUE.—A. G. Bloxam (Soc. of Chemical Industry in Basle). Oct. 1, 1931. 388,840.

PROCESS OF DYEING OR COLOURING ORGANIC MATERIALS.—I. G. Farbenindustrie. Nov. 3, 1930. 388,861.

PROCESS FOR IMPROVING THE PROPERTIES OF NATURAL WAXES.—J. Y. Johnson (I. G. Farbenindustrie). Nov. 11, 1931. 388,864.

MANUFACTURE OF ARTIFICIAL SILK.—Cellulose Acetate Silk Co., Ltd., C. C. Tyrer and H. G. Anderson. Nov. 19, 1931. 388,871.

MANUFACTURE AND PRODUCTION OF NITRILES.—J. Y. Johnson (I. G. Farbenindustrie). Nov. 26, 1931. 388,874.

MANUFACTURE AND PRODUCTION OF ASSISTANTS FOR THE TEXTILE AND RELATED INDUSTRIES.—J. Y. Johnson (I. G. Farbenindustrie). Nov. 28, 1931. 388,876.

MANUFACTURE AND PRODUCTION OF ASSISTANTS FOR THE TEXTILE AND ALLIED INDUSTRIES.—J. Y. Johnson (I. G. Farbenindustrie). Nov. 28, 1931. 388,877.

MANUFACTURE OF VAT-DYESTUFFS OF THE ANTHRAQUINONE SERIES.—I. G. Farbenindustrie. Dec. 17, 1930. 388,889.

SENSITISING SILVER HALIDE EMULSIONS.—I. G. Farbenindustrie. Jan. 10, 1931. 388,898.

MANUFACTURE AND PRODUCTION OF COLOURED MASSES AND SOLUTIONS THEREOF.—*J. Y. Johnson* (I. G. Farbenindustrie). Jan. 23, 1932. 388,910.

TREATMENT OF RUBBER LATEX AND LIKE AQUEOUS DISPERSIONS OF RUBBER.—Soc. Italiana Pirelli and G. Venosta. Feb. 9, 1932. 388,923.

MANUFACTURE OF CONDENSATION PRODUCTS OF HIGH MOLECULAR WEIGHT.—J. R. Geigy Akt.-Ges. March 16, 1931. 388,936.

PROCESS FOR THE MANUFACTURE OF PURE TITANIUM DIOXIDE.—I. G. Farbenindustrie. June 15, 1931. 388,978.

METHOD OF CHLORINATING SULPHIDE ORES.—Intermetal Corporation. Oct. 3, 1931. 389,005.

PROCESS AND COMPOSITION FOR REMOVING OXIDES AND GASES FROM MOLTEN ALUMINIUM AND ALUMINIUM ALLOYS.—K. Schmidt Ges. Jan. 30, 1932. 389,020.

MANUFACTURE OF THIOUREA.—Soc. of Chemical Industry in Basle. Oct. 6, 1931. 389,033.

PRODUCTION OF STABLE COMPOUNDS OF THE PRIMULA SAPONIN.—H. D. Elkington (P. Peiersdorf and Co., Akt.-Ges.). Oct. 20, 1932. 389,037.

MANUFACTURE OF THIOUREA.—Soc. of Chemical Industry in Basle. Jan. 27, 1932. 389,042.

PRODUCTION OF PURE BARIUM COMPOUNDS.—"Sachtleben" Akt.-Ges. für Bergbau und Chemische Industrie. Dec. 7, 1931. 389,044.

PREPARATION OF OXIDE OF BERYLLIUM.—Compagnie de Produits Chimiques et Electrometal-Lurgiques Alais, Froges, et Camargue. Nov. 28, 1931. 389,045.

PROCESS FOR THE MANUFACTURE OF ACID ANHYDRIDES.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Nov. 3, 1931. 389,049.

PROCESS OF PREPARATION OF BERYLLIUM FLUORIDE FROM A DOUBLE FLUORIDE OF BRYLLIUM AND AN ALKALI METAL.—Compagnie de Produits Chimiques et Electrometallurgiques Alais, Froges, et Camarque. Dec. 19, 1931. 389,053.

Applications for Patents

PURIFICATION OF ALUMINIUM OR ALUMINIUM BASE ALLOYS.—Aluminium, Ltd. Jan. 8, 1932. 389,054.

DEVICES FOR PURIFYING LIQUIDS.—C. H. Biehler and G. Eyrsartes. March 6. (Luxembourg, March 7, '32.) 6706. March 6. (France, July 27, '32.) 6707. March 6. (France, Oct. 24, '32.) 6708 (cognate with 6706).

LIQUIDS OF PLASTIC PREPARATIONS.—H. T. Böhme Akt.-Ges. March 8. (Oct. 17, '32.) (Germany, Nov. 7, '31.) 7078, 7079.

MANUFACTURE OF ASYMMETRICAL THIOUREA DERIVATIVES.—A. Carpmael (I. G. Farbenindustrie). March 10. 7329.

MANUFACTURE OF ARTICLES FROM THERMOPLASTIC MATERIALS.—Celluloid Corporation. March 9. (United States, March 9, '32.) 7244.

MANUFACTURE OF PHENOLS FROM HALOGENATED AROMATIC HYDROCARBONS.—Chemische Fabrik Von Heyden Akt.-Ges. March 9. (Germany, June 22, '32.) 7189.

MANUFACTURE OF OXYDIPHENYL-ETHER-CARBOXYLIC ACIDS.—Chemische Fabrik Von Heyden Akt.-Ges. March 9. (Germany, May 13, '32.) 7190.

DYESTUFFS.—Chemische Fabrik vorm. Sandoz. March 11. (Switzerland, March 12, '32.) 7465.

DELUSTRING PROCESS.—Chemische Fabrik vorm. Sandoz. March 12, '32.) 7466. March 11. (Switzerland, May 25, '32.) 7467 (cognate with 7466).

PRODUCTION OF VOLATILE METALS.—H. E. Coley. March 8. 7040.

TREATMENT OF TEXTILE MATERIALS.—Imperial Chemical Industries, Ltd., and J. W. C. Crawford. March 6. 6756.

MANUFACTURE OF ESTERS OF METHACRYLIC ACID.—Imperial Chemical Industries, Ltd., and J. W. C. Crawford. March 10. 7354.

PRODUCTION OF PHOSPHORUS OXYCHLORIDE.—Imperial Chemical Industries, Ltd., and A. I. Davies. March 9. 7233.

PRODUCTION OF METAPHOSPHATES.—Imperial Chemical Industries, Ltd., and A. I. Davies. March 9. 7234.

PURIFICATION OF HYDROCARBONS.—E. G. Hancock and W. H. Hoffert. March 6. 6684.

MANUFACTURE OF MIXED ANHYDRIDES OF SILICIC ACID AND CARBOXYLIC ACIDS.—Henkel et Cie, Ges. March 9. (Germany, April 22, '32.) 7243.

MANUFACTURE OF DYESTUFFS.—W. W. Groves (I. G. Farbenindustrie). March 10. 7334.

OBTAINING CHLORIDES OF THE CERIUM GROUP.—I. G. Farbenindustrie Akt.-Ges. March 9. (Germany, March 12, '32.) 7168.

MANUFACTURE CF 4-AMINODIPHENYLAMINE DERIVATIVES.—I. G. Farbenindustrie. March 9. (Germany, March 9, '32.) 7191, 7192 (cognate with 7191), 7193 (cognate with 7191).

SENSITISING SILVER HALIDE EMULSIONS.—I. G. Farbenindustrie. March 10. (Germany, March 10, '32.) 7335.

MANUFACTURE OF NITROGENOUS CONDENSATION PRODUCTS.—I. G. Farbenindustrie. March 11. (Germany, March 19, '32.) 7422.

TEXTILE ASSISTANTS.—Imperial Chemical Industries, Ltd. March 10. 7353.

DISAZO DYESTUFFS, ETC.—Imperial Chemical Industries, Ltd. March 11. 7435.

MANUFACTURE OF MATERIALS CONTAINING RUBBER.—International Latex Processes, Ltd. March 9. 7140.

MANUFACTURE OF DISAZO DYESTUFFS.—J. Y. Johnson (I. G. Farbenindustrie). March 6. 6734.

MANUFACTURE OF INTAGLIO PRINTING INKS.—J. Y. Johnson (I. G. Farbenindustrie). March 6. 6735.

MANUFACTURE OF CONDENSATION PRODUCTS OF THE AROMATIC SERIES.—J. Y. Johnson (I. G. Farbenindustrie). March 6. 6736.

MANUFACTURE OF SUBSTANCES SUITABLE AS WETTING, ETC., AGENTS.—J. Y. Johnson (I. G. Farbenindustrie). March 6. 6737.

MANUFACTURE OF ASSISTANTS FOR TEXTILE, ETC., INDUSTRIES.—J. Y. Johnson (I. G. Farbenindustrie). March 7. (Sept. 28, '31). 6906.

MANUFACTURE OF POLYMERISATION PRODUCTS.—J. Y. Johnson (I. G. Farbenindustrie). March 11. 7423.

MANUFACTURE OF DYESTUFFS.—J. Y. Johnson (I. G. Farbenindustrie). March 11. 7424.

MANUFACTURE OF UNSATURATED KETONES.—Schering-Kahlbaum Akt.-Ges. March 8. (Germany, March 11, '32.) 7097. (Germany, May 4, '32). 7098 (cognate with 7097). (Germany, Sept. 20, '32.) 7099 (cognate with 7097). (Germany, Sept. 20, '32.) 7100 (cognate with 7097).

MANUFACTURE OF CELLULOSE DERIVATIVES.—Soc. of Chemical Industry in Basle. March 6. (Switzerland, March 4, '32.) 6744.

From Week to Week

A SUM OF £1,040 has recently been disbursed among local charities by the employees of the North British Rubber Co., Ltd., Edinburgh.

A SANTIAGO DE CHILE TELEGRAM says that the Central Bank has voted the sum of 9,000,000 pesos (£225,000 at par) monthly to sustain the nitrate industry during the period of liquidation of Cosach.

FIRE ENGINES from all parts of London were called out on Monday night to assist in subduing a blaze at the factory and warehouse of G. M. Smith, Italian warehousemen and manufacturers of paint and varnishes, Chadwick Road, Peckham. It was one of the fiercest fires in London for many years.

THE BOARD OF TRADE announces that the Treasury has made an Order under Section 10 (5) of the Finance Act, 1926, exempting acid carbolic (synthetic), phenol (synthetic), benzo-phenal (synthetic) from key industry duty from March 15, to December 31, 1933.

THE WELBECK DISTILLATION CO., LTD., according to the "London Gazette," resolved at a meeting on March 2, that, by reason of its liabilities, the company be wound up voluntarily, and that Mr. Frederick Cass Young, Hooles Chambers, Bank Street, Sheffield, be nominated liquidator of the company.

FIFTY-NINE EMPLOYEES of the Castner Kellner alkali works of Imperial Chemical Industries, Ltd., at Runcorn, were presented with long-service awards on Wednesday. Three employees who had forty years' service, G. Comley, J. Newall and T. Stephens, received gold medals. Thirty-seven men who had 35 years' service received gold watches, and 19 men with 25 years' service received silver watches and medals. The combined services of the men reached nearly 2,000 years.

THE DOMINION BUREAU OF STATISTICS at Ottawa is about to publish the third edition of the Directory of the Chemical Industries in Canada, the previous issues being those for 1919 and 1921. Part I will contain an alphabetical list of manufacturers showing the head office addresses, plant locations and detailed lists of products, whilst Part II consists of an alphabetical list of commodities with the names of the producers in each case. Copies of the Directory will be available at Canada House, Trafalgar Square, London, S.W.1.

THE COAL-MINING INDUSTRY has been keenly interested in the contract which the Air Ministry has placed for twelve months' supplies of aviation petrol made from British coal. Mr. W. R. Gordon, director of the Coal Utilisation Council, which was recently formed by the joint efforts of the coal owners, distributors and exporters, stated on Monday that all coal producers look forward to the day when every ton of fuel oil consumed by the Navy will be coal oil, and every gallon of petrol consumed by the Air Force will be coal petrol.

THE CHEMICAL SOCIETY has now appointed local representatives in the various areas into which the country is divided, with the object of extending its usefulness to its fellows. One of their duties is the organisation of meetings and lectures to keep the fellows who are engaged in industry, teaching and other occupations in touch with the advances now taking place in chemistry. Dr. F. Fairbrother, of the Manchester University, and Dr. E. H. Rodd, of Timperley, have been appointed to the Manchester area, which is a large one. Under this arrangement, a lecture on "How chemical reactions 'go' " is to be given by Professor E. K. Rideal, of Cambridge, in the Chemical Theatre at the University.

IN HIS FRIDAY EVENING DISCOURSE at the Royal Institution on March 10, Lord Rutherford gave an account of the evidence that had led Dr. Anderson, of the University of Pasadena, and Mr. P. M. S. Blackett and Dr. Occhialini, of the Cavendish Laboratory, to postulate the existence of a "positive electron." He showed photographs of the bombardment of matter by cosmic rays, obtained by Mr. Blackett. The rays were of much greater energy than could be obtained in the laboratory, and the photographs gave strong evidence that when the rays struck the nucleus of an atom disintegration took place. It was from this suggested that there must be a particle with a positive charge of mass less than that of the proton.

THE IRAQ PETROLEUM CO., LTD., has placed the complete contract for main oil line pumps with Worthington-Simpson, Ltd., Newark-on-Trent. This important order, secured in world-wide competition, comprises forty-five 6¾ in. by 24 in. horizontal duplex double acting outside packed plunger forged fluid end pumps, with single reduction of helical gear and all moving parts entirely enclosed to prevent the ingress of sand. The pumps, which will transport oil through the two great pipe-lines totalling 1,200 miles—from east of the Tigris to Tripoli and Haifa on the Mediterranean Sea—will be driven by 500 b.h.p. diesel engines, delivering against a line pressure of 800 lb. All the pumps have been designed and will be constructed throughout at the Worthington-Simpon works at Newark-on-Trent.

THE "CITY OF SHANGHAI" has loaded thirty tons of chemicals from Billingham and is waiting for a further load of the same material. She also has other war material on board.

THE OIL AND COLOUR CHEMISTS' ASSOCIATION announces that the next meeting will be held on April 6 and not April 13, as originally arranged, and that the annual dinner will be held on March 24.

MR. E. C. HARRINGTON, of Harrington and Goodlass Wall, Ltd., Shandon Chemical Works, Shandon, County Cork, has been elected as a manufacturing member of the Council of the Irish National Agricultural and Industrial Development Association for 1933.

THE CALICO PRINTERS' ASSOCIATION has dismantled and are to dispose of four of its factories—at Lennoxtown, Bridge of Weir, Milton of Campsie, and Barrhead, owing to trade depression. The factories, which cost £150,000, employed 1,000 hands between them.

IN THE GLASGOW Eastern Police Court last week, the certificate of the Society for the Protection of Life from Fire was presented to Mr. William Symington, works manager of Wm. Blackadder and Co., Ltd., oil and varnish manufacturers, Glasgow.

MR. ARTHUR S. WINDER, of Sheffield, has been elected to the Board of the English Steel Corporation, Ltd., and also appointed general manager of the company, directly responsible to Commander C. W. Craven, the managing director. The English Steel Corporation combines the steel interests of Vickers-Armstrong (at Sheffield and Openshaw) and Cammell Lairds.

AN OPTIMISTIC STATEMENT regarding the outcome of the negotiations to take place in Teheran at the end of this month in connection with the Anglo-Persian oil dispute, was made on March 10, by Fathollah Khan Nouri Esfandiari, the new Persian Charge d'Affaires in London. Nouri Khan said that he believed the present situation was much more favourable than when the difficulty first occurred. The firm opinion in Persia is that it was of paramount importance that both our countries should work together, as they have in the past.

THE FUNCTION OF RESEARCH in relation to industry is two-fold, said Mr. A. P. M. Fleming, a director of the Metropolitan-Vickers Electrical Co., Ltd., addressing the Institute of Industrial Administration recently on "Research in Relation to Industry"—first, to assist in making the transformation of natural resources to finished products most efficient, that is, with the minimum of waste; and, second, to develop new knowledge which will beget new industries. The second function, the creation of new industrial activities, is of the most significance at the present time, as it represents the best means of absorbing unemployment.

FRENCH EXPERTS AND A MINING BOARD appointed by the government of the Irish Free State are to undertake a mineral survey of an area of approximately 300 square miles in the Irigna Valley, extending over the counties of Roscommon and Leitrim. From time to time in the past small chemical deposits have been located in this district, but it has never been properly surveyed for the purpose of finding the exact position or extent of the deposits. A number of research workers are to accompany the expedition which will probably be at work for some months. Its final report will be presented to the Free State Minister for Industry and Commerce who will consider the best methods by which the deposits can be exploited commercially.

SIMPLE APPARATUS AND TESTS for the efficient control of water softeners, were described by Mr. P. J. Goodger, of Sofnol, Ltd., in a lecture given to Midland Section of the Society of Dyers and Colourists at the Technical College, Leicester, on March 8. The lecturer pointed out the necessity for soft water in many industries, including the dyeing, bleaching, woollen and tanning industries. The principles involved in the theory of the chemistry of water softening, by lime and soda with sodium aluminate and by the base exchange method were discussed. He dealt with the best type of apparatus for water testing, and most convenient and accurate solutions and indicators to be used, giving special significance to the hardness and alkalinity tests. Tests were carried out with Sofnol testing apparatus, using Wanklyn strength soap solution, standard acid and Sofnol indicators for treated and untreated waters on samples of crude treated and boiler waters.

Obituary

J. D. BRUNT, at West Kirby, Cheshire. Mr. Brunt was head of J. D. Brunt and Co., sugar brokers. He was a director of Sugar Association of Lancashire and past chairman of the Beetroot Sugar Association.

ARCHIBALD ANNAN DICKSON, at his home at Plymouth, last week. For the last twenty-five years Mr. Dickson has been in business on his own account as a paper merchant, and was well known throughout the West Country. Aged 80.

International Nickel Report

Drastic Retrenchment Effected

In their report for the year ending December 31, 1932, the directors of International Nickel Co. of Canada, Ltd., show a net loss of $135,345, compared with a net profit of $5,094,497 for 1931. The net operating income was $3,363,400, against $9,220,309, from which was deducted $735,307 for interest and reserves other than depreciation and mine depletion, leaving $2,628,093, which is $664,184 in excess of preferred dividend disbursements. Reflecting an improvement in business which began in the second half of the year, the final quarter of 1932 showed a net profit, after all deductions other than those for preferred dividends, of $157,008. This compares with net losses of $199,097 in the third quarter and of $629,327 in the second. A dividend at the rate of 7 per cent. per annum on the preferred stock for the quarter is payable on May 1 to holders of record on April 1.

In order to maintain a strong financial position drastic retrenchment was effected throughout all branches of the company's activities. With the completion of major construction items capital expenditures during 1932 were very much less than in former years and should be even less in the current year, as there is little probability of any new construction being required for some time to come.

Sales of nickel in all forms, including nickel in alloys, amounted to 34,406,953 lb. compared with 55,739,047 lb. in 1931, a decrease of 38 per cent. The world's consumption of nickel in all forms aggregated 57,000,000 lb. compared with 73,000,000 lb. in 1931 and 88,000,000 lb. in 1930. Sales of Monel metal, made direct from Creighton ore, totalled 7,624,298 lb. compared with 13,158,745 lb. in 1931, a decrease of 42 per cent.; and sales of rolled nickel, 3,938,782 lb. were off 4 per cent. Copper sales, inclusive of copper sulphate produced in Wales, decreased from 96,919,677 lb. to 57,652,789 lb. or 41 per cent.

The Clydach Refinery

At the Clydach Refinery (Mond Nickel Co., Ltd.), Wales, the output of nickel in 1932 was 7,416,464 lb., compared with 16,546,740 lb. for 1931, a decrease of 55 per cent. The plant operated continuously on a reduced scale for the first six months of the year, the pellet nickel department being closed from July 1 until the middle of December, when operations were resumed. During the shutdown the calcination department was completely rebuilt, and this, with the new central grinding department and other improvements, assures lower operating costs. Arrangements were made to spread the available work so as to give a maximum number of men some employment. The reconstruction of the calcination department, together with the opening of the salts department in November, made possible about 90 per cent. employment for the year as compared with 1931.

The Acton Precious Metal Refinery

At the Acton Refinery (Mond Nickel Co., Ltd.), London, owing to the reduced scale of operations at Port Colborne and Clydach the supply of precious metals concentrates which form the raw material for this works was greatly reduced, entailing a corresponding reduction in the output of platinum and palladium. Platinum production was 26,213 ounces compared with 44,725 ounces for 1931, and the production of palladium fell from 39,313 ounces in 1931 to 29,496 ounces in 1932. The purity of finished metals has consistently improved. Experimental work looking to the increased use of the platinum metals was actively prosecuted throughout the year, and further progress was made in the electro-plating of palladium, resulting in two process patents.

World Consumption of Non-Ferrous Metals

The year 1932 witnessed a continuation of decrease in the consumption of non-ferrous metals throughout the world, and the consumption of many of them sank to low levels not reached in the preceding ten years. Nickel shared in this experience. The estimated world consumption of nickel in all forms in 1932 was 57,000,000 lb. as compared with 73,000,000 lb. in 1931, indicating a recession of about 22 per cent., a figure comparable with that for non-ferrous metals. Total nickel deliveries in the world market, excluding America, were only 7 per cent. less in 1932 than in 1931, practically all of the decrease in total nickel consumption having occurred in the American market, where the decrease amounted to about 37 per cent. as compared with 1931.

World consumption of the metals of the platinum group fell off substantially in 1932, due principally to the unsatisfactory condition of the jewellery trade, as well as to the lack of activity in the electrical industries. Considerable technical progress has been made in the electroplating of these metals and it is now possible to plate palladium in substantial thicknesses—up to 0.020 inches. Types of platinum-gold and of the palladium-gold alloys of white colour have been developed and described which appear to be well adapted for dental construction, and are being currently produced and offered by dental manufacturers.

Prices of Chemical Products

Current Market Conditions

The volume of business placed during the past week has been on the whole satisfactory and markets show very little change. Prices continue firm with the undertone strong. There is no change in the market conditions of coal tar products. General political uncertainty has been reflected in a somewhat nervous condition of the Manchester chemical market during the past week, and, so far as this centre is concerned, buyers continue to do little more than cover requirements over relatively short periods. Cotton mill activity in Lancashire shows no expansion and consequently there has not been much improvement in conditions in the bleaching, dyeing and finishing establishments, although the call for contract deliveries of chemicals from this direction is maintained fairly well. Here and there chemical prices have eased a little bit, for the most part, the general tendency is undoubtedly steady. The Scottish market has shown a decided improvement during the week. Prices remain unchanged from last week, with the following exceptions:—

General Chemicals

Acid, Citric.—London: 10d. per lb.; less 5%. Manchester: 9½d. to 9¾d.

Arsenic.—London: £22 14s. c.i.f. main U.K. ports for imported material; Cornish nominal, £23 f.o.r. mines. Scotland: White powdered, £27 ex wharf; spot, £26. Manchester: White powdered Cornish, £23 to £24 at mines.

Carbon Tetrachloride.—£41 to £46 per ton, drums extra.

Diphenylguanidine.—2s. 2d. per lb.

Pharmaceutical and Fine Chemicals

Potassium Bitartrate, 99/100%.—82s. per cwt.

Essential Oils

Almond.—Foreign, S.P.A., 9s. 6d. per lb.

Bergamot.—7s. per lb.

Cananga, Java.—10s. 9d. per lb.

Cassia, 80/85%.—4s. 9d. per lb.

Citronella, Java.—2s. 10d. per lb.

Clove, English, 90/92%.—5s. per lb.

Lavender, Mont Blanc, 38/40%.—11s. per lb.

Lemon.—5s. per lb.

Otto of Roses.—Anatolian, 37s. 6d.; Bulgarian, 35s. per lb.

Peppermint.—Wayne County, 12s. 3d. per lb.

Coal Tar Products

Acid, Carbolic.—Crystals, 9d. to 11d. per lb.; crude, 60's, 1s. 11d. to 2s. per gal.; 2% water, 3s. 0¾d. Manchester: Crystals, 9¼d. per lb.; crude, 2s. 4d. per gal. Scotland: 60's, 1s. 7d. to 1s. 8d.

Pitch.—Medium soft, £4 10s. to £4 15s. per ton. Manchester: £4 5s. to £4 10s. f.o.b. London: £4 5s. to £4 10s. f.o.b. East Coast port.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Journal of the Italian Chamber of Commerce in London." Names and addresses may be obtained from The Secretary, Italian Chamber of Commerce in London (Inc.), 10 Queen Street, London, E.C.4.

Cement.—Important Italian firm of cement manufacturers is open to appoint agents in London, Birmingham, Liverpool and Manchester having first-class connection with principal export houses buying for African and Eastern markets. (Ref. No. 523.)

White Lead, Etc.—Exporter in Genoa wishes to get into touch with buyers in Great Britain of genuine dry white lead, red lead and powdered barytes. (Ref. No. 429.)

Essential Oils.—A firm in Reggio Calabria wishes to get into touch with importers and consumers of essential oils. (Ref. No. 6334.)

Asphalte.—Firm of asphalte producers in Rome wishes to get into touch with principal road paving contractors using this material. (Ref. No. 6476.)

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Canada.—A firm of manufacturers' agents at Toronto desire to obtain United Kingdom agencies for battery chemicals, including ammonium chloride and accumulator acid, on a purchasing basis in Eastern Canada. (Ref. No. 389.)

Denmark.—A commission agent established at Copenhagen wishes to obtain representation of United Kingdom manufacturers of perfumery, on a commission basis. Correspondence may be in English. (Ref. No. 404.)

Finland.—A firm of commission agents in Tammelsfors wishes to obtain supplies of industrial chemicals from United Kingdom export agents. (Ref. No. 405.)

Forthcoming Events

Mar. 20.—Royal Society of Arts. "Welding and Allied Processes for Engineering Purposes." (Lecture III). Arthur Stephenson. 8 p.m. John Street, Adelphi, London.

Mar. 20.—Institution of the Rubber Industry (Manchester Section). "Modern Compounding." R. C. Davies. College of Technology, Manchester.

Mar. 21.—The Institute of the Plastics Industry (London Section). "A Review of Plastics Abroad." W. Einert. 7.30 p.m. Windsor Castle Hotel, Victoria Station, London.

Mar. 21.—Hull Chemical and Engineering Society. "Beet Sugar." J. H. Wilson. Grey Street, Park Street, Hull.

Mar. 22.—Electroplaters' and Depositors' Technical Society. The William James Memorial Lecture.

Mar. 22.—Leicester Literary and Philosophical Society (Chemistry Section). "Poisons and Poisoners." Dr. G. M. Dyson. 7.30 p.m. College of Technology, Leicester.

Mar. 22.—Society of Chemical Industry (Food Group). Papers by Members of the Group. 7.30 p.m. Burlington House, London.

Mar. 23.—Society of Chemical Industry and Institute of Chemistry (Edinburgh Sections). "Drikold." Dr. Littler. 8 p.m. North British Station Hotel, Edinburgh.

Mar. 23.—Society of Chemical Industry (Edinburgh and East of Scotland Section). Annual General Meeting. 7.30 p.m. North British Station Hotel, Edinburgh.

Mar. 23.—Students' Chemical Society of the Manchester College of Technology. "Pure Water." H. G. B. Robinson. "Goniometry." Dr. Statham. 5 p.m. Large Chemical Lecture Theatre, E.17.

Mar. 24.—Institute of Fuel (East Midlands Section). Joint meeting with the Institution of Mechanical Engineers at the Technical College, Green Lane, Derby.

Mar. 24.—The Institute of the Plastics Industry (Midlands Section). "How I Should Meet a Moulding Enquiry." A. G. Snell. 7.30 p.m. Imperial Hotel, Birmingham.

New Companies Registered

Barrow Coal Distillation, Ltd. Worsborough, near Barnsley. Registered March 10. Nominal capital £100 in £1 shares. Objects: To deal in coal, coke, by-products, products of tar distillation, chemicals, patent fuel and oils; to coke coal, conduct chemical research, manufacture chemicals, and carry on the business of chemists, druggists, distillers, dye, soap and gas makers, metallurgists, engineers, etc. Directors: The Hon. Robert James, A. G. Morrish, W. F. Egerton, W. Hay, and F. Hill-Cole.

H. Brooks and Co. (Hull), Ltd., Little Howard Street, Chapman Street, Hull. Registered February 24. Nominal capital £1,000. Objects: To acquire the business of H. Brooks and Co. carried on by H. H. Brooks, W. Nolan and C. C. D. Johansen at Little Howard Street, Chapman Street, Hull, and to carry on the business of manufacturers of and dealers in laboratory and scientific furniture, apparatus and materials, chemicals, drugs, disinfectants, fertilisers, toilet requisites, etc. Directors: H. Brooks, William Nolan, and C. C. D. Johansen.

Rainshore Bleaching & Dyeing Company, Ltd. Registered March 13. Nominal capital £5,000 in £1 shares. Bleachers, dyers, finishers, mercerisers, scourers, printers, waterproofers, chemists, etc. Directors: A. Barlow, "Rainshore," Norden, near Rochdale, and Mrs. M. E. Barlow.

Snowunda, Ltd. Registered on March 13. Nominal capital £3,000 in £1 shares. To acquire the business of a soap manufacturer now carried on by Roy Parsons at West Row, Stockton-on-Tees, together with the Registered trade mark "Snowunda." Directors: James Morland, Ingledene, Richmond Road, Stockton-Tees, A. B. Walford, and R. Parsons.

Dolphin & Co., Ltd., 83 Colmore Row, Birmingham. Registered March 4. Nominal capital £5,000 in £1 shares. Manufacturers of and dealers in mechanical, chemical and scientific apparatus, chemicals, etc. Directors: J. R. Dolphin and Mrs. J. M. Dolphin.

Company News

Tarmac, Ltd.—A dividend of 5 per cent., subject to tax, has been declared on the ordinary shares.

William Blythe & Co.—A final dividend of 10 per cent., making 12 per cent. for the year, less tax, is announced on the ordinary shares. The annual meeting will be held on April 10.

Minerals Separation, Ltd.—A final dividend of 10 per cent., less tax, is payable on March 27, making 15 per cent. for the year. The annual meeting will be held at Winchester House, London, on March 27 at 2.30 p.m.

Canadian Industries, Ltd.—The statement for the year 1932 shows that net earnings were $2,771,500, as compared with $3,433,500 in the previous year. The surplus carried forward is $11,092,000, compared with $11,229,000 in 1931.

The Powell Duffryn Steam Coal Co.—The trading profits for the year 1932 were £403,241, or nearly £100,000 higher than in 1931. Provision for depreciation is doubled at £100,000, and the amount carried forward is £74,075, against £32,710. The annual meeting will be held on March 23, at Southern House, London, at 12 noon.

British Aluminium Co.—The profit for 1932, including the carry-forward from 1931, after providing for taxation, interest on debenture stock and placing £50,000 to depreciation reserve (raising it to £1,100,000), and £10,000 to the staff fund, is £162,031. The directors recommend a dividend of 5 per cent. for the year on the ordinary shares, leaving £51,979 to be carried forward.

British Portland Cement Manufacturers, Ltd.—The directors recommend, after providing for debenture stock sinking funds and £255,000 for depreciation reserves, as last year, a final dividend of 10 per cent., less tax, on the ordinary shares, making 15 per cent. for 1932, leaving to be carried forward £200,522, as compared with £206,009 last year. The dividend is the same as for 1931.

Associated Portland Cement Manufacturers, Ltd.—After providing for debenture stock sinking funds and £337,150 for depreciation reserves, an increase of £25,000 on 1931, the directors recommend a dividend of 7 per cent., less tax, on the ordinary shares in respect of 1932. This compares with the previous year's payment of 8 per cent. on 3,000,000 shares and 4 per cent on 500,000 shares issued in August, 1931. The amount carried forward is £166,728, against £163,427 brought in.

Salt Union, Ltd.—The net profit for the year 1932 amounts to £206,831, which, after adding £14,036 brought forward, and deducting debenture interest £42,000, leaves available £178,867. It is proposed to pay a dividend of 2s. 4d. per share on the preference shares, a dividend of 9 per cent. on the ordinary shares, to place to staff fund £1,000, to contingencies account £20,000, and to carry forward £15,867. The annual meeting will be held at India Buildings, Water Street, Liverpool, March 21, at 11.30 a.m.

Dominion Tar & Chemical Co.—The consolidated statement of profit and loss surplus account for 1932 shows combined earnings from operations, after deducting operating, management and selling expenses, exclusive of earnings applicable to minority share interests and before providing for depreciation of properties and tax, $505,013. After adding surplus at December 31, 1931, etc., and deducting depreciation on properties, income tax, etc., there remains $991,531. Dividends paid and declared on the preferred shares Dominion Tar and Chemical Co., Ltd., absorb $81,818, leaving a balance of $912,716.

Delta Metal Co.—For the year 1932 the report states that the balance of trading account was £54,640; to this is added dividends from subsidiary companies £13,312, and registration fees £30, making £67,982, less directors' fees and remuneration £3,960, auditors' fees £315, reserve for taxation £13,000, and depreciation £14,605, leaving a net profit of £36,102. The balance brought forward was £15,592, making available £51,694. The directors recommend a dividend at the rate of 12½ per cent., free of tax, absorbing £37,500, and leaving to be carried forward £14,194. The annual meeting will be held at Southern House, Cannon Street, London, on March 8, at 2 p.m.

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